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THE

ANATOMY

OF THE

HUMAN BODY.

VOL. I.

LEEDS
SCHOOL OF
MEDICINE

CONTAINING THE

ANATOMY

OF THE

BONES, MUSCLES, AND JOINTS,

THE SECOND EDITION.

By JOHN BELL, Surgeon.

EDINBURGH:
Printed for Cadell and Davies, London;
and G. Mudie and Son, Edinburgh.
1797.

TO

ALEXANDER WOOD

SURGEON,

WHOSE ABILITIES, AND SKILL, AND DISINTERESTED CONDUCT,

HAVE RAISED HIM, BY COMMON CONSENT,

TO THE FIRST RANK, IN A MOST USEFUL PROFESSION,

CONDUCTING HIM, IN HONOUR, TO THAT PERIOD OF LIFE

IN WHICH HE MUST FEEL, WITH PLEASURE,

HOW COMPLETELY HE ENJOYS THE CONFIDENCE OF THE PUBLIC,

AND THE ESTEEM OF ALL GOOD MEN,

THIS BOOK OF ANATOMY IS PRESENTED BY HIS PUPIL

JOHN BELL.

PREFACE.

To thoſe who are at all acquainted with books on anatomy, the appearance of a new one on the ſubject will not be ſurpriſing: To thoſe who are not yet acquainted with ſuch writings, I have only to ſay, that I have written this book, becauſe I believed that ſuch a one was needed, and muſt be uſeful. I have endeavoured to make it ſo plain and ſimple as to be eaſily underſtood; I have avoided the tedious interlarding of technical terms (which has been too long the pride of anatomiſts and the diſgrace of their ſcience), ſo that it may read ſmoothly, compared with the ſtudied harſhneſs, and, I may ſay, obſcurity, of anatomical deſcription. If an author may ever be allowed to compare his book with others, it muſt be in the mechanical part; and I may venture to ſay, that this book is full and correct in the anatomy, free and general in the explanations, not redundant, I hope, and yet not too brief.

If, in the courſe of this volume, I ſhall appear to have given to theories a place and importance far higher than they really deſerve, my reader will naturally feel how uſeful they are in preſerving the due balance between what is amuſing and what is uſeful; between the looſer doctrines of functions and the cloſe demonſtration of parts. He will be ſenſible how much more eaſily theſe things can be read in the cloſet than taught in any public courſe; he will, I think, be ready to acknowledge, that I introduce ſuch theories only as ſhould connect the whole, and may be fairly diſtinguiſhed as the phyſiology of facts; and he will perceive, that in this, too, I feel a deference for the public opinion, and that reſpect for the eſtabliſhed courſe of education which it is natural to feel and to comply with.

Thus, perhaps, it is leſs immodeſt for an author to put down what he thinks he may honeſtly ſay concerning his own book, than to omit thoſe apologies which cuſtom requires; which give aſſurance that he has not entered upon his taſk raſhly, nor performed it without ſome labour and thought; which are the trueſt ſigns of his reſpect for the Public, and of his care for that ſcience to which he has devoted his life.

With theſe intentions and hopes I offer this book to the Public; and more particularly to thoſe in whoſe education I have a chief concern: not without a degree of ſatisfaction at having accompliſhed what, I think, cannot fail to be uſeful; and ſurely not without an apprehenſion of not having done (in this wide and difficult ſubject) all that may be expected or wiſhed for.

Every book of this kind ſhould form a part of ſome greater ſyſtem of education: it ſhould not only be entire in its own plan, but ſhould be as a part of ſome greater whole; without which ſupport and connection a book of ſcience is inſulated and loſt. This relation and ſubſerviency of his own particular taſk to ſome greater whole, is firſt in an author's mind: he ventures to look forward to its connection with the general ſcience and common courſe of education; or he turns it to a correſpondence and harmony with his own notions of ſtudy: and if theſe notions are to give the complexion and character to any book, it ſhould be when it is deſigned for thoſe who are entering upon their ſtudies, as yet uncertain where to begin, or how to proceed.

Hardly any one has been ſo fortunate as to purſue the ſtudy of his own ſcience under any regular and perfect plan; and there are very few with whom a conſciouſneſs of this does not make a deep and ſerious impreſſion at ſome future period, accompanied with ſevere regret for the loſs of time never to be retrieved. In medicine, perhaps, more than in any other ſcience, we begin our ſtudies thoughtleſs and undecided, following whatever is delightful (as much is delightful), and neglecting the more ſevere and uſeful parts: But as we advance towards that period in which we are to enter upon a moſt difficult profeſſion, and to take our place and ſtation in life; and when we think of the heſitation, anxiety, and apprehenſion, with which we muſt move through the firſt years of practice—we begin to look back with regret on every moment that is paſt; with a conſciouſneſs of ſome idle hours; and (what is more afflicting ſtill) with an unavailing ſenſe of much ill-directed, unprofitable labour:—for there is no ſtudy upon which a young man enters with a more eager curioſity; but not inſtructed in what is really uſeful, nor ſeriouſly impreſſed with the importance of his future profeſſion, he thinks of his ſtudies rather as the amuſement, than as the buſineſs, of life; ſlumbers through his more laborious and uſeful taſks, and ſoon falls off to the vain purſuit of theories and doctrines.

If I were not perſuaded of the important conſequences, of the infinite gain or loſs which muſt attend the firſt ſteps in every profeſſion, I ſhould not feel, but, above all, I ſhould not venture to expreſs, an anxiety, which may be thought affected by thoſe who cannot know how ſincere it muſt be; for, in our profeſſion, this is the courſe of things, that a young man, who, by his limited fortune, or the will of his friends, by abſence from his native country, or by the deſtination of his future life, is reſtricted to a few years of irregular, capricious, ill directed ſtudy, throws himſelf at once into the practice of a profeſſion, in which, according to his ignorance or ſkill, he muſt do much good or much harm. Here there is no time for his excurſions into that region of airy and fleeting viſions, and for his returning again to ſedate and uſeful labour: There is no time for his diſovering, by the natural force of his own reaſon, how vain all ſpeculations are:—In but a few years, at moſt, his education is determined; the limited term is completed ere he have learnt that moſt uſeful of all leſſons, the true plan of ſtudy; and his opportunities come to be valued (like every other happineſs), only when they are loſt and gone.

Of all the leſſons which a young man entering upon our profeſſion needs to learn, this is, perhaps, the firſt,—that he ſhould reſiſt the faſcinations of doctrines and hypotheſes, till he have won the privilege of ſuch ſtudies by honeſt labour, and a faithful purſuit of real and uſeful knowledge. Of this knowledge, anatomy ſurely forms the greater ſhare.—Anatomy, even while it is neglected, is univerſally acknowledged to be the very baſis of all medical ſkill.—It is by anatomy that the phyſician gueſſes at the ſeat, or cauſes, or conſequences, of any internal diſeaſe:—Without anatomy, the ſurgeon could not move one ſtep in his great operations; and thoſe theories could not even be conceived, which ſo often uſurp the place of that very ſcience, from which they ſhould flow as probabilities and conjectures only, drawn from its ſtore of facts.

A conſciouſneſs of the high value of anatomical knowledge never entirely leaves the mind of the ſtudent. He begins with a ſtrong conviction that this is the great ſtudy, and with an ardent deſire to maſter all its difficulties: if he relaxes in the purſuit, it is from the difficulties of the taſk, and the ſeduction of theories too little dependent on anatomy, and too eaſily acceſſible without its help. His deſire for real knowledge revives only when the opportunity is loſt; when he is to leave the ſchools of medicine; when he is to give an account of his ſtudies with an anxious and oppreſſed mind, conſcious of his ignorance in that branch which is to be received as the chief teſt of his profeſſional ſkill; or when, perhaps, he feels a more ſerious and manly impreſſion, the difficulty and importance of that art which he is called to practiſe.

Yet, in ſpite of feeling and reaſon, the ſtudent encourages in himſelf a taſte for ſpeculations and theories, the idle amuſements of the day, which, even in his own ſhort courſe of ſtudy, he may obſerve ſinking in quick ſucceſſion into neglect and oblivion, never to revive; he aſpires to the character of a phyſiologiſt, to which want of experience, and a youthful fancy, have aſſigned a rank and importance which it does not hold in the eſtimation of thoſe who ſhould beſt know its weakneſs or ſtrength. The raweſt ſtudent, proud of his phyſiological knowledge, boaſts of a ſcience and a name which is modeſtly diſclaimed by the firſt anatomiſt, and the trueſt phyſiologiſt of this or any age. Dr Hunter ſpeaks thus of his phyſiology, and of his anatomical demonſtration: "Phyſiology, as far as it is known, or has "been explained by Haller, and the beſt of the mo-"derns, may be eaſily acquired by a ſtudent without "a maſter, provided the ſtudent is acquainted with "philoſophy and chemiſtry, and is an expert and rea-"dy anatomiſt; for with theſe qualifications he can "read any phyſiological book, and underſtand it as "faſt as he reads.

"In this age, when ſo much has been printed upon "the ſubject, there is almoſt as little inducement to "attend lectures upon phyſiology, as there would be "for gentlemen to attend lectures upon government, "or upon the hiſtory of England. Lectures upon "ſubjects which are prefectly intelligible in print, can-"not be of much uſe, except when given by ſome man

" of great abilities, who has laboured the ſubject, and " who has made conſiderable improvements either in " matter or in arrangement.

" In our branch, thoſe teachers who take but little " pains to demonſtrate the parts of the body with pre- " ciſion and clearneſs, but ſtudy to captivate young " minds with ingenious ſpeculation, will not leave a " reputation that will outlive them half a century.

" I always have ſtuided, and ſhall continue my en- " deavours, to employ the time that is given up to ana- " tomical ſtudies as uſefully to the ſtudents as I can " poſſibly make it—and therefore ſhall never aim at " ſhowing what I know, but labour to ſhow and de- " ſcribe, as clearly as poſſible, what they ought to " know. This plan rejects all declamation, all parade, " all wrangling, all ſubtility: to make a ſhow, and to " appear learned and ingenious in natural knowlege, " may flatter vanity; to know facts, to ſeparate them " from ſuppoſitions, to range and connect them, to " make them plain to ordinary capacities, and, above " all, to point out the uſeful applications—is, in my " opinion, much more laudable, and ſhall be the ob- " ject of my ambition*."

Edinburgh,
Sept. 1793.

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* Introductory Lecture publiſhed by Dr Hunter.

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THE
ANATOMY
OF THE
BONES, MUSCLES, AND JOINTS.

BOOK I.

OF THE BONES.

CHAP. I.

OF THE FORMATION AND GROWTH OF BONES.

It is not eaſy to explain, in their natural order, the various parts of which the human body is compoſed; for they have that mutual dependence upon each other, that continual circle of action and re-action in their various functions, and that intricacy of connection, and cloſe dependence, in reſpect of the individual parts, that, as in a circle there is no point of preference from which we ſhould begin to trace its courſe, ſo in the human body there is no function ſo inſulated from the other functions, no part ſo independent of other parts, as to determine our choice. We cannot begin without heſitation, nor hope to proceed in any perfect courſe; yet, from whatever point we begin, we may ſo return to that point, as to repreſent truly this conſent of functions, and connection of parts, by which it is compoſed into one perfect whole.

The bones are framed as a baſis for the whole ſyſtem; fitted to ſupport, defend, and contain the more delicate and noble organs. They are the moſt permanent and unchangeable of all parts of the body. We ſee them expoſed to the ſeaſons, without ſuffering the ſmalleſt change; remaining for ages the memorials of the dead; the evidence of a former race of men exceeding ours in ſtrength and ſtature; the only remains of creatures which no longer exiſt; the proofs of ſuch changes on our globe, as we cannot trace but by theſe uncertain marks. Thus we are apt to conceive, that even in the living body, bones are hardly organized; ſcarcely partaking of life; not liable, like the ſoft parts, to diſeaſe and death. But minute anatomy, the moſt pleaſing part of our ſcience, unfolds and explains to us the internal ſtructure of the bones; ſhows their myriads of veſſels; and proves them to be as full of blood as the moſt ſucculent and fleſhy parts; having, like them, their periods of growth and decay; being as liable to accidents, and as ſubject to internal diſeaſe.

The phenomena of fractured bones firſt ſuggeſted ſome indiſtinct notions of the way in which bone might be formed. It was obſerved, that in very aged men, a hard cruſt was often formed upon the ſurface of the bones; that the fluid exuding into the joints of gouty people, ſometimes coagulated into a chalky maſs; Le Dran had ſeen in a caſe of ſpina ventoſa, or ſcrophulous bone, an exudation which flowed out like wax, and hardened into perfect bone; Daventer had ſeen the juice that exuded from a ſplit in a bone, coagulate into a bony cruſt; and it was thought to be particularly well aſcertained, that callus was but a coagulable juice, which might be ſeen exuding directly from the broken ends of a bone, and which gradually coagulated into hard bone. The beſt phyſiologiſts did not ſcruple to believe, that bones, and the callus of broken bones, were formed of a bony juice, which was depoſited by the veſſels of the part, and which paſſing through all the ſucceſſive conditions of a thin uncoagulated juice, of a tranſparent cartilage, and of ſoft and flexible bone, became at laſt, by a ſlow coagulation, a firm, hard, and perfect bone; depending but little upon veſſels or membranes, either for its generation or growth, or for nouriſhment in its perfect ſtate. But this coagulation is a property of dead matter, which has no place in the living ſyſtem; or if blood or mucus do ever coagulate within the body, it is only after they are ſeparated from the ſyſtem. Coagulation is a ſort of accident in the living body; and it is not to be believed that the accidental concourſe of parts ſhould form the perfect ſyſtem of a living bone; nor that coagulation, an irregular uncertain proceſs, ſhould keep pace with the growth of the living parts; that a bone which is completely organized, and a regular part of the living ſyſtem, ſhould, in all its progreſs towards this perfect ſtate, be merely inanimate, inorganized matter: Yet this opinion once prevailed; and if other theories were at that time propoſed, they did not vary in any very eſſential point from this firſt notion. De Heide, a ſurgeon of Amſterdam, believed that bone or callus were not formed from a coagulable juice, but from the blood itſelf,

ſelf. He broke the bones of animals, and, examining them at various points of time, he never failed (like other ſpeculators) to find exactly what he deſired to find. In "every experiment," he found a great effuſion of blood among the muſcles, and round the broken bone: and he as eaſily traced this blood through all the ſtages of its progreſs; on the firſt day red and fluid; by and by coagulated; then gradually becoming white, then cartilaginous, and at laſt (by the exhalation of its thinner parts) hardening into perfect bone.

It is very ſingular, that often thoſe who abjure theory, and appeal to experiments, who profeſs only to deliver facts, are leaſt of all to be truſted; for it is theory which brings them to try experiments, and then the form and order; and even the reſult of ſuch experiments, muſt bend to meet the theories which they were deſigned to prove. It is by this deception that the authors of two rival doctrines arrive at oppoſite concluſions by facts directly oppoſed to each other. Du Hamel believed, that as the bark formed the wood of a tree, adding, by a ſort of ſecretion, ſucceſſive layers to its growth; ſo the perioſteum formed the bone at the firſt, renewed it when ſpoiled or cut away, and, when broken, aſſumed the nature of bone, and repaired the breach. He broke the bones of pigeons, and, allowing them to heal, he found the perioſteum to be the chief organ for reproducing bone. He found that the callus had no adheſion to the broken bone, and was eaſily ſeparated from the broken ends which remained rough and bare. And, in purſuing theſe diſſections, he found the perioſteum fairly glued to the external ſurface of the new bone; or he found rather the callus or regenerated bone to be but a mere thickening of the perioſteum, its layers being ſeparated, and its ſubſtance ſwelled. On the firſt days he found the perioſteum thickened, inflamed, and eaſily divided into many lamellæ, or plates; but while the perioſteum was ſuffering theſe changes, the bone was in no degree changed. On the following days, he found the tumor of the perioſteum increaſed at the place of the fracture, and extending further along the bone; its internal ſurface already cartilaginous, and always tinged with a little blood, which came to it through the veſſels of the marrow. He found the tumor of the perioſteum ſpongy, and diviſible into regular layers, while ſtill the ends of the bone were unchanged, or only a little roughened by the firſt layer of the perioſteum being already converted into earth, and depoſited upon the ſurface of the bone: and in the next ſtage of its progreſs, he found the perioſteum firmly attached to the ſurface of the callous maſs. By wounding, not breaking, the bones, he had ſtill a more flattering appearance of a proof; for having pierced them with holes, he found the holes filled up with a ſort of tompion, proceeding from the perioſteum, which was thickened all round them. In an early ſtage, this plug could, by drawing the perioſteum, be pulled out from its hole: In a more advanced ſtage, it was inſeparably united to the bone, ſo as to ſupply the loſs.

Haller, doubting whether the perioſteum, a thin and delicate membrane, could form ſo large a maſs of bone or callus, repeated the proofs; and he again found quite the reverſe of all this: That the callus, or the original bone, were in no degree dependent on the perioſteum, but were generated from the internal veſſels of the bone itſelf: That the perioſteum did indeed appear as early as the cartilage which is to produce the bone, ſeeming to bound the cartilage, and give it form; but that the perioſteum was at firſt but a looſe tiſſue of cellular ſubſtance, without the appearance of veſſels, or any mark of blood, adhering chiefly to the heads or proceſſes, while it hardly touched the body of the bone. He alſo found that the bone grew, became vaſcular, had a free circulation of red blood, and that then only the veſſels of the perioſteum began to carry red blood, or to adhere to the bone. We know that the bones begin to form in ſmall nuclei, in the very centre of their cartilage, or in the very centre of the yet fluid callus, far from the ſurface, where they might be aſſiſted by the perioſteum; and that oſſification begins firſt in the middle of the long bones, where the perioſteum does not adhere, and is formed much later in the heads and proceſſes, whoſe connection with the perioſteum is very cloſe.

Thus has the formation of bone been falſely attributed to a gelatinous effuſion, gradually hardened; or to that blood which muſt be poured out from the ruptured veſſels round a fractured bone; or to the induration and change of the perioſteum, depoſiting layer after layer, till it completed the form of the bone.

But when, neglecting theory, we ſet ourſelves to examine, with an unbiaſſed judgment, the proceſs of nature in forming the bones, as in the chick, or in reſtoring them, as in broken limbs, a ſucceſſion of phenomena preſent themſelves, the moſt orderly, beautiful, and ſimple, of any that are recorded in the philoſophy of the animal body: for if bones were but condenſed gluten, coagulated blood, or a mere depoſition from the perioſteum, they were then inorganized, and out of the ſyſtem, not ſubject to change, nor open to diſeaſe; liable, indeed, to be broken, but without any means of being healed again: while they are, in truth, as fully organized, as permeable to the blood, as eaſily hurt, and as eaſily healed, as ſenſible to pain, and as regularly changed as the ſofter parts are. We are not to refer the generation and growth of bone to any one part. It is not formed by that gelly in which the bone is layed; nor by the blood which is circulating in it; nor by the perioſteum which covers it; nor by the medullary membrane with which it is lined: but the whole ſyſtem of the bone, of which theſe are parts only, is deſigned and planned, is laid out in the very elements of the body, and advances to ripeneſs, by the concurring action of all its parts. The arteries, by a determined action, depoſite the bone; which is formed commonly in a bed of cartilage, as the bones of the leg or arm are; ſometimes betwixt two layers of membrane, like the bones of the ſkull, where true cartilage is never ſeen. Often the ſecretion of the bony matter is performed in a diſtinct bag, and there it grows into form, as in the teeth; for each tooth is formed in its little bag, which, by injection, can be filled and covered with veſſels. Any artery of the body may aſſume this action, and depoſite bone, which is ſometimes alſo formed where it ſhould not be; in the tendons and in the joints, in the great arteries, and in [illegible] their [illegible] their valves, in the fleſh of the heart itſelf, or even in the ſoft and pulpy ſubſtance of the brain.

All the bones of the body, both in the human fœtus, and in other animals, are merely cartilage before the time of birth. The whole fœtus is gelatinous; the bones are a pure, almoſt tranſparent and tremulous gelly; they are flexible, ſo that a long bone can be bent into a complete ring; and no opacity, nor ſpot of oſſification is ſeen.

This cartilage is never hardened into bone; but, from the firſt, it is in itſelf an organized maſs. It has its veſſels; which are at firſt tranſparent, but which ſoon dilate, and whenever the red colour of the blood begins to appear in them, oſſification very quickly follows, the arteries being ſo far enlarged as to carry the coarſer parts of the blood. The firſt mark of oſſification is an artery, which is ſeen running into the centre of the gelly in which the bone is to be formed. Other arteries ſoon appear; overtake the firſt; mix with it, and form a net-work of veſſels; then a centre of oſſification begins, ſtretching its rays according to the length of the bone, and then the cartilage begins to grow opaque, yellow, brittle; it will no longer bend, and the ſmall nucleus of oſſification is felt in the centre of the bone, and when touched with a ſharp point, is eaſily known by its gritty feel. Other points of oſſification are ſucceſſively formed; the oſſification being always foretold by the ſpreading of the artery, and by the arrival of red blood. Every point of oſſification has its little arteries, and each oſſifying nucleus has ſo little dependence on the cartilage in which it is formed, that it is held to it by theſe arteries only; and when the oſſifying cartilage is cut into thin ſlices, and ſteeped in water till its arteries rot, the nucleus of oſſification drops ſpontaneouſly from the cartilage, leaving the cartilage like a ring, with a ſmooth and regular hole where the bone lay.

The colour of each part of a bone is proportioned exactly to the degree in which its oſſification has advanced. When oſſification begins in the centre of the bone, redneſs alſo appears; indicating the preſence of thoſe veſſels by which the bony matter is to be poured out. When the bony matter begins to accumulate, the red colour of thoſe arteries is obſcured, the centre of the bone becomes yellow or white, and the colour ſeems to be removed towards the ends of the bone. In the centre, the firſt colouring of the bone is a cloudy, diffuſed and general red, becauſe the veſſels are profuſe. Beyond that, at the edges of the firſt circle, the veſſels are more ſcattered, and diſtinct trunks are eaſily ſeen, forming a circle of radiating arteries, which point towards the heads of the bone. Beyond that, again, the cartilage is tranſparent and pure, being yet untouched with blood; the arteries have not reached it, and its oſſification is not begun. Thus, a long bone, while forming, ſeems to be divided into ſeven variouſly coloured zones. The central point of moſt perfect oſſification is yellow and opaque. On either ſide of that, there is a zone of red. On either ſide of that again, the veſſels being more ſcattered, form a vaſcular zone*, and the zone at either end is tranſparent

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* It is curious to obſerve how completely vaſcular the bone of a chicken is before the oſſification have fairly begun; how the oſſification

rent or white. The oſſification follows the veſſels, burying and hiding thoſe veſſels by which it is formed: The yellow and opaque part expands and ſpreads along the bone: The veſſels advance towards the heads of the bones: The whole body of the bone becomes opaque, and there is left only a ſmall vaſcular circle at either end: the heads are ſeparated from the body of the bone by a thin cartilage; and the veſſels of the centre, extending ſtill towards the extremities of the bone, perforate that cartilage, paſs into the head of the bone, and then its oſſification alſo begins, and a ſmall nucleus of oſſification is formed in its centre. Thus the heads and the body are, at the firſt, diſtinct bones formed apart and joined by a cartilage; and they are not united till the age of fifteen or twenty years.

The veſſels are ſeen entering in one large trunk (the nutritious artery) into the middle of the bone: From

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ſification having begun, overtakes the arteries, and hides them, changing the tranſparent and vaſcular part of the bone into an opaque white; how, by peeling off the perioſteum, bloody dots are ſeen, which ſhows a living connection and commerce of veſſels betwixt the perioſteum and the bone; how, by tearing up the outer layers of the tender bone, the vaſcularity of the inner layers is again expoſed. But of all the proofs of the vaſcularity of bones and depoſition of the bony matter, the moſt beautiful is that of our common preparations; where, after filling with injection the arteries of an adult bone, by its nutritious veſſels, we, by corroding the bone with mineral acids, diſſolve the earth, leaving nothing but the tranſparent gelly, and thus reſtore the bone to its original cartilaginous ſtate; then the veſſels appear in ſuch profuſion, that the bone may be compared in vaſcularity with the ſoft parts, and it is ſeen that its arteries were not annihilated, but its high vaſcularity only concealed by the depoſition of the bony parts.

From that centre they extend in a radiated form towards either end, and the fibres of the bone are radiated in the ſame direction; there are furrows betwixt the rays, and the arteries run along in the furrows of the bone, as if the arteries were forming theſe ridges, ſecreting and pouring out the bony matter, each artery piling it up on either ſide to form its ridge. The body of the bone is ſupplied by its own veſſels; the heads of the bone are ſupplied by the extremities of the ſame trunks which perforate the dividing cartilage like a ſieve; the perioſteum adhering more firmly to the heads of the bone, it brings aſſiſtant arteries from without, which meet the internal trunks, and aſſiſt the oſſification; but with every help, the oſſification is not accompliſhed in many years.

It is by the action of the veſſels that all the parts of the human body are formed; fluids and ſolids, each for its reſpective uſe. The blood is formed by the action of the veſſels, and all the fluids are in their turn formed from the blood. We ſee in the chick, where there is no external ſource from which its red blood can be derived, that red blood is formed within its own ſyſtem. Every animal ſyſtem, as it grows, aſſimulates its food, and converts it to the animal nature, and ſo increaſes the quantity of its red blood: And as the red blood is thus prepared by the actions of the greater ſyſtem, the actions of particular veſſels prepare various parts: ſome to be added to the maſs of ſolids, for the natural growth; others to ſupply the continual waſte; others to be diſcharged from the body as effete, and hurtful, or to allow new matter to be received; others again to perform certain offices within the body, as the ſecretion of ſemen, of ſaliva, of bile, or of urine. Thus the body is furniſhed with various apparatus for performing various offices, and for repairing the waſte. Theſe are the ſecretions, and the formation of bone is one of theſe. The plan of the whole body lies in the embryo, in perfect order, with all its forms and parts. Cartilage is laid in the place of bone, and preſerves its form for the future bone, with all its apparatus of ſurrounding membranes, its heads, it proceſſes, and its connection with the ſoft parts. The colourleſs arteries of this pellucid, but organized maſs of cartilage keep up its growth; extend, and yet preſerve its form; and gradually enlarging in their own diameter, at laſt receive the entire blood. Then the depoſition of earthy matter begins. The bone is depoſited in ſpecks, which ſpread and meet, and form themſelves into perfect bone. While the bone is laid by arteries, the cartilage is conveyed away by the abſorbing veſſels; and while they convey away the ſuperfluous cartilage, they model the bone into its due form; ſhape out its cavities, cancelli, and holes; remove the thinner parts of the cartilage, and harden it into due conſiſtence.

If ſuch organization of arteries to depoſite bone, and of abſorbents to take up the cartilage and make room for the oſſeous matter, be neceſſary in the formation and growth, it is no leſs neceſſary for the life and health of the full formed bone. Its health depends on the regular depoſition and reabſorption, moulding and forming the parts; and by various degrees of action, bone is liable to inflame, to ulcerate, to rot and ſpoil, to become brittle by too much ſecreted earth, or to become ſoft by a greedy diſeaſed abſorption of its earthy parts. The earth, which conſtitutes the hardneſs, and all the uſeful properties of bone, is dead, inorganized, and lies in the interſtices of the bone; where it is united with mucus, to give it conſiſtence and ſtrength; furniſhed with abſorbents to keep it in health, and carry off its waſted parts; and pervaded by veſſels to ſupply it with new matter. The cartilage is itſelf a ſecretion, to which the full ſecretion of bone ſucceeds, as the arteries grow ſtronger in their ſecreting office: for in a broken limb there is firſt a thin effuſion, then a tremulous gelly, then radiated veſſels, then oſſifying ſpots, and theſe running together form perfect bone. If the broken limb be too much moved during the cure, then the ſecreting arteries are interrupted in their office; perfect bone is never formed; it remains a cartilage; and an unnatural joint is produced: but we cut the ſurface of theſe cartilages, and then the veſſels are opened again, the proceſs is renewed, and the bones unite; or even by rubbing, by ſtimulating, by merely cutting the ſurrounding parts, the veſſels are made active, and their ſecretion is renewed. During all the proceſs of oſſification, the abſorbents proportion their action to the ſtimulus which is applied to them; they carry away the ſerous fluid, when gelly is to take its place; they remove the gelly, as the bone is laid; they continue removing the bony particles alſo, which (as in a circle) the arteries continually renew.

Nothing can be more curious than this continual renovation and change of parts, even in the hardeſt bones. We are accuſtomed to ſay of the whole body, that it is daily changed; that the old particles are removed; and new ones ſupply their place; that the body is not now the ſame individual body that it was: but it could not be eaſily believed that we ſpeak only by gueſs concerning the ſofter parts, what we know for certain of the bones. It was diſcovered by chance, that animals fed upon the refuſe of the dyer's vats, received ſo much of the colouring matter into the ſyſtem, that the bones were tinged by the madder to a deep red, while the ſofter parts were unchanged; no tint remaining in the ligaments nor cartilages; in the membranes, veſſels, nor nerves; not even in the delicate veſſels of the eye. It was eaſy to diſtinguiſh by the microſcope, that ſuch colour was mixed with the bony matter, and reſided in the interſtices only, but did not remain in the veſſels of the bone, which like thoſe of all the body had no tinge of red; while our injections again fill the veſſels of the bone, make all their branches red, but do not affect the colours of the bony part. When madder is given to animals, withheld for ſome time, and then given again, the colour appears in their bones; is removed; and appears again, with ſuch a ſudden change as proves a rapidity of depoſition and abſorption exceeding all likelihood or belief. All the bones are tinged in twenty-four hours; in two or three days their colour is very deep: and if the madder be left off but for a few days, the red colour is entirely removed.

This tinging of the bones with madder, was the great inſtrument employed by Du Hamel, for proving by demonſtration, that it was by layers from the perioſteum that the bone was formed; and how very far the mind is vitiated by this vanity of eſtabliſhing a doctrine on facts, is to eaſily ſeen here. As Du Hamel believed that the perioſteum depoſited ſucceſſive layers, which were added to the bone, it was his buſineſs to prove that the ſucceſſive layers would be depoſited alternately red, white, and red again, by giving a young animal madder, withholding it for a little while, and then beginning again to give it. Now, it is eaſy to foreſee that this tinging of the lamellæ ſhould correſpond with the ſucceſſive times in which the perioſteum is able to depoſite the layers of its ſubſtance; but Du Hamel very thoughtleſsly makes his layers correſpond only with the weeks or months in which his madder was given or withheld. It is eaſy to foreſee alſo, that if madder be removed from the bones in a few days (which he himſelf has often told us), then his firſt layer, viz. of red bone, could not have waited for his layer of white to be laid above it, nor for a layer of red above that again, ſo as to enable him to ſhow ſucceſſive layers: And if madder can ſo penetrate, as to tinge all the bones that are already formed, then, though there might be firſt a tinged bone, then a white and colourleſs layer, whenever he proceeded to give madder for tinging a third layer, it would pervade all the bone, tinge the layer below, and reduce the whole to one tint. If a bone were thus to increaſe by layers, thick enough to be viſible, and of a diſtinct tint; and if ſuch layers were to be continually accumulated upon each other every week, what kind of a bone ſhould this grow to? Yet ſuch is the faſcinating nature of a theory, that Du Hamel, unmindful of any interruptions like theſe, deſcribes boldly his ſucceſſive layers; carrying us through regular details, experiment after experiment, till at laſt he brings up his report to the amount of five ſucceſſive layers, viz. two red layers, and three white ones: Nay, in one experiment he makes the tinge of the madder continue in the bones for ſix months, forming ſucceſſive layers of red and white; although, in an earlier experiment (which he muſt have forgotten in his hurry), he tells us, that by looking through the tranſparent part of a cock's wing, he had ſeen the tinge of the madder gradually leave the bones in a few days.

Theſe experiments are as groſs and palpable as the occaſion of them; and ſhould ſtand as a warning to us, ſhowing how ſeverely and honeſtly we ought to queſtion our own judgment, when we aim at confirming our preconceived theories by experiments and facts.

Yet by theſe experiments with madder, one moſt important fact is proved to us; that the arteries and abſorbents, acting in concert, alternately depoſite and reabſorb the earthy particles, as faſt as can be conceived of the ſoft parts, or even of the moſt moveable and fluctuating humours of the body. The abſorption of the hardeſt bones is proved by daily obſervation. When a carious bone diſappears before the integuments are opened; when a tumour, preſſing upon a bone, deſtroys it; when an aneuriſm of the temporal artery deſtroys the ſkull; when an aneuriſm of the heart beats open the thorax, deſtroying the ſternum and ribs; when an aneuriſm of the ham deſtroys the thigh-bone, tibia, and joint of the knee; when a tumour coming from within the head, forces its way through the bones of the ſkull;—in all theſe caſes, ſince the bone cannot be annihilated, what can happen, but that it muſt be abſorbed and conveyed away? If we ſhould need any ſtronger proofs than theſe, we have molities oſſium; a diſeaſe by which, in a few months, the bony ſyſtem is entirely broken up, and conveyed away, by a high action of the abſorbents, with continual and deep-ſeated pain, a diſcharge of the earthy matter by the urine, and a gradual ſoftening of the bones, ſo that they bend under the weight of the body; the heels are turned up behind the head; the ſpine becomes crooked; the pelvis diſtorted; the breaſt is cruſhed and bent in: and the functions beginning to fall low, the patient, after a ſlow hectic fever, long and much ſuffering of pain and miſery, expires; with all the bones diſtorted in a ſhocking degree; gelatinous, or nearly ſo, robbed of all their earthy parts; and ſo thoroughly ſoftened that they may be cut with the knife.

Thus every bone has, like the ſoft parts, its arteries, veins and abſorbent veſſels. And every bone has its nerves too: We ſee them entering into its ſubſtance in ſmall threads, as on the ſurfaces of the frontal and parietal bones: We ſee them entering for particular purpoſes, by a large and peculiar hole, as the nerves which go into the jaws to reach the teeth: We find delicate nerves going into each bone along with its nutritious veſſels; and yet we dare hardly believe the demonſtration, ſince bones ſeem quite inſenſible and dead. We have no pain when the perioſteum is raſped and ſcraped from a bone: We have no feeling when bones are cut in amputation; or when, in a broken limb, we cut off with pincers the protruding end of a bone: We feel no pain when a bone is trepaned, or when cauſtics are applied to it; and it has been always known, that the heated irons which the old ſurgeons uſed ſo much, made no other impreſſion upon the bone than to excite a particular titillation and heat, rather pleaſant than painful, running along the courſe of the bone. But there is a deception in all this. A bone may be exquiſitely ſenſible, and yet give no pain; a paradox which is very eaſily explained. A bone may feel acutely, and yet not ſend its ſenſation to the brain. It is not fit that parts ſhould in this ſenſe feel, which are ſo continually expoſed to ſhocks and blows, and all the accidents of life; which have to ſuffer all the motions which the other parts require. In this ſenſe, the bones, the cartilages, ligaments, burſæ, and all the parts that relate to joints, are quite inſenſible and dead. A bone does not feel, or its feelings are not conveyed to the brain; but with this ſingle exception, it ſhows every mark of life. Scrape a bone, and its veſſels bleed; cut or bore a bone, and its granulations ſprout up; break a bone, and it heals; or cut a piece of it away, and more bone will be readily produced; hurt it in any way, and it inflames; burn it, and it dies: take any proof of ſenſibility, but the mere feeling of pain, and it will anſwer to the proof. In ſhort, theſe parts have a ſenſibility which belongs to themſelves, but have no feelings in correſpondence with the general ſyſtem.

A bone feels ſtimuli, and is excited to react; injuries produce inflammation in the bones, as in the ſoft parts; and then ſwelling and ſpongy looſeneſs, and a fulneſs of blood, ſuppuration, ulcer, and the death and diſcharge of the diſeaſed bone enſue. When the texture of a bone is thus looſened by inflammation, its feeling is rouſed; and the hidden ſenſibility of the bone riſes up like a new property of its nature: and as the eye, the ſkin, and all feeling parts, have their ſenſibility increaſed by diſeaſe, the bones, ligaments, burſæ, and all the parts whoſe feeling, during health, is obſcure and hardly known, are rouſed to a degree of ſenſibility far ſurpaſſing the ſoft parts. The wound of a joint is indeed leſs painful at firſt, but when the inflammation comes, its ſenſibility is raiſed to a dreadful degree: the patient cries out with anguiſh. No pains are equal to thoſe which belong to the bones and joints.

Thus oſſification is a proceſs of a truly animal nature: no coagulation will harden cartilage into bone; no change of conſiſtency will convert the blood into it; no condenſation of the perioſteum can aſſimilate it to the nature of a bone. Bone is not the inorganic concrete which it was once ſuppoſed; but it is a regularly organiſed part, whoſe form ſubſiſts from the firſt; and which is perfected by its ſecreting arteries, balanced, as in every ſecretion, by the abſorbents of the part; it lives, grows and feels; is liable to accidents, and ſubject to diſeaſe. It is a proceſs which, at firſt, appears ſo rapid, that we ſhould expect it to be ſoon complete; but it becomes in the end a ſlow and difficult proceſs. It is rapid at firſt; it advances ſlowly after birth; it is not completed in the human body till the twentieth year; it is forwarded by health and ſtrength, retarded by weakneſs and diſeaſe. In ſcrofula it is imperfect; and ſo children become rickety, the bones ſoftening and ſwelling at their heads, and bending under the weight of the body. And why ſhould we be ſurpriſed, that careleſſneſs of food or clothing, bad air, or languid health, ſhould cauſe that dreadful diſeaſe, when more or leſs heat, during the incubation of a chick, affects the growth of its bones; when the ſickneſs of a creature, during our experiments, protracts the growth of callus; when, in the accidents of pregnancy, of profuſe ſuppuration, or of languid health, the knitting of broken bones is delayed, or wholly prevented.

This proceſs, ſo difficult and ſlow, is aſſiſted by every proviſion of nature. The progreſs of the whole is ſlow, that as long as the body increaſes in ſtature, the bones alſo may grow; but it is aſſiſted in the individual parts, where ſome are ſlow; ſome rapid in their growth; ſome delayed, as the heads of joints, that their bones may be allowed to extend; and others haſtened, as the pelvis, that they may acquire their perfect ſize early in life. Oſſification is aſſiſted by the ſoftneſs of the cartilaginous bed in which the bone is formed; by thoſe large and permeable veſſels which carry eaſily the groſſer parts of the blood; by a quick and powerful abſorption, which all along is modelling the bone; and, moſt of all, by being formed in detached points, multiplied and crowded together, wherever much bone is required.

There is one central ring firſt oſſified in a long bone, as of the leg or arm; the heads or ends of the bone are at firſt mere cartilage, but they alſo ſoon begin to oſſify; the body ſtretches in a radiated form towards either head; the heads oſſifying each in its centre, alſo ſtretch towards the bone; the heads meet the body, and join to it; a thin cartilage only is interpoſed, which grows gradually thinner till the twentieth year, and then diſappears; the body, heads, and proceſſes, becoming one bone. In flat bones, as in the ſkull, oſſification goes from one or more central points, and the radiated fibres meet the radii of other oſſifying points, or the edges of the next bone. The thick round bones which form the wriſt and foot, have one oſſification in their centre, which is bounded by cartilage all round. The proceſſes are often diſtinct oſſifications joined to the bones, like their heads, and ſlowly conſolidated with them into firm bones*.

While the bone is forming, various parts, eſſential to its ſyſtem, gradually riſe into view. At firſt, we cannot in the long bone perceive any heads, proceſſes, cavities, or cells; theſe parts are very ſlowly formed, and are perfected only in the adult bone.

At firſt, the whole length of a long bone is repreſented by a tranſparent gelly; where there is no diſtinction of heads nor proceſſes, it is all of one maſs. After the red blood has begun to tinge this cartilage, the oſſification begins, and one ring is formed in the middle of the bone: from this ring, the fibres ſtretch towards either end, and ſtop there; then it begins to appear that the heads and body are diſtinct parts; the fibres of the growing bone have extended till the cartilage is annihilated, and only a ſmall plate remains, ſeparating the knobs of the heads from the long body of the bone. Thus, there is no diſtinction betwixt the heads and the body, while the bone is cartilaginous; they begin to appear, as diſtinct parts, at that ſtage in which the body of the bone is oſſified, and each of the heads is beginning to form; they continue three diſtinct bones, during all the early part of life, and are eaſily ſeparated, by ſoaking the bone in water; when they are ſeparated, there is ſeen a rough hollow on the ſurface of the epiphyſis, or ſeparated head, and a rough convexity on the end of the body: they are finally united into one bone, about the twentieth year.

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* The proceſſes and heads are named the epiphyſis and apophyſis of bones.

In the original cartilage, there is no hollow, nor cavity; it is all one ſolid maſs. When the oſſification firſt appears, the cavity of the bone alſo begins, and extends with the oſſification. At firſt, the cavity is confined chiefly to the middle of the bone, and extends very ſlowly towards the ends. This cavity, in the centre of the bone, is at firſt ſmooth, covered by an internal membrane, containing the trunks and branchings of the nutritious veſſels, which enter by a great hole, in the middle of the bone; and the cavity is traverſed, with diviſions of its lining membrane, which, like a net-work of partitions, conduct its branches to all parts of the internal ſurface of the bone; and its nets, or meſhes, are filled with a reddiſh and ſerous fluid, in the young bone, but ſecrete and contain a perfect marrow in the adult bone.

The whole ſubſtance of a bone is not only fibrous, as appears outwardly, but is truly lamellated, conſiſting of many diſtinct and delicate plates of bone; which lie over each other in regular order, and might ſuggeſt the notion that ſucceſſive oſſifications of the perioſteum form the bone. Theſe lamellæ, or plates, are more condenſed and firmer towards the outer ſurface; and are more looſe, ſeparate, and ſpongy, towards the internal ſurface of the bone:

and

and it is eaſily ſeen, during the growth of a young bone, that the inner and more delicate plates are ſeparating from the walls of the bone, and receding towards its cavity ; and theſe plates, being again croſſed by ſmall bony partitions, form a net-work, or ſpongy maſs, which fills the whole cavity of the bone. In the middle of the bone, the cavity is ſmall, the walls are thick, and have all their bony plates ; the cells of net-work are few, and large : but towards the ends, the bone ſwells out ; the cavity alſo is large, but it is not like that in the middle, a large tubular cavity ; it is ſo croſſed with lattice-work, with ſmall interſtices and cells, that it ſeems all one ſpongy maſs of bone; and ſo many of the inner layers are ſeparated, to form this profuſion of cells, that the whole ſubſtance of the bone has degenerated into this lattice-work, leaving only a thin outward ſhell *. This reticular form is what anatomiſts call the cancelli, lattice-work, net-work, or alveolar part of the bone ; it is lined throughout with one delicate membrane ; and inward partitions of the ſame lining membrane cover each diviſion of the lattice-work, forming each cell into a diſtinct cavity. In theſe cavities or cells the marrow is ſecreted. The ſecretion is thin and bloody in children ; it thickens as we advance in years ; it is a ſolid oil, or marrow, in the adult. The marrow is firmer, and more perfect in the

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* That it is merely an expanſion of the layers that forms the cancelli, and a mere ſwelling and ſpongineſs of the ſame quantity of bony ſubſtance, that makes the ends ſo much thicker than the middle, is proved by this, that an inch of the ſmaller bony tube, cut from the middle, weighs equally with an inch of the large ſpongy tube, cut out from the ends.

the middle of the bone; more thin and ſerous towards the ſpongy ends. The whole maſs, when ſhaken out of the bone, is like a bunch of grapes, each hanging by its ſtalk. The globules, when ſeen with the microſcope, are neat, round, and white, ſeeming like ſmall pearls, and each ſtalk is ſeen to be a ſmall artery, which comes along the membrane of the cancelli, ſpreads its branches beautifully on the ſurface of the bag, and ſerves to ſecrete the marrow, each ſmall twig of artery filling its peculiar cell. To this, an old anatomiſt added, that they had their contractile power, like the urinary bladder, for expelling their contents; that they ſqueezed their marrow, by channels of communication, through and among the bony layers; and that their oil exuded into the joint, by nearly the ſame mechaniſm by which it got into the ſubſtance of the bone.

While the conſtitution of a bone was not at all underſtood, anatomiſts noted with particular care, every trifling peculiarity, in the forms or connections of its parts, and theſe lamellæ attracted particular notice. That a bone is formed in ſucceſſive plates, is eaſily ſeen, as in whalebone; or in the horns and bones of the larger animals; in church-yard bones, which have been long buried, or long expoſed to the air. It is demonſtrated by a careful picking, and ſeparation of the ſcales, in a young bone, or by burning a bone, which melts and conſumes its gelly, and leaves the bony parts entire. It is ſeen in the common diſeaſes of bones; for they caſt off by ſucceſſive plates, or leaves, whence the proceſs is named exfoliation; and one plate is thoroughly ſpoiled and caſt off, whilſt another is entire, and ſound. Malpighi had firſt obſerved the lamellated ſtructure of bones, likening them to the leaves of a book. Gagliardi, who, like Hippocrates, went among the burial places of the city, to obſerve the bones there, found in a tomb, where the bones had been long expoſed, a ſkull, the os frontis of which he could diſſect into many layers, with the point of a pin. He afterwards found various bones, from all parts of the body, thus decompoſed; and he added to the doctrine of plates, that they were held together by minute proceſſes, which, going from plate to plate, performed the offices of nails: Theſe appeared to his imagination to be of four kinds, ſtraight and inclined nails, crooked or hook-like, and ſome with ſmall round heads, of the forms of bolts or pins *.

Another notable diſcovery, was the uſe of the holes which are very eaſily ſeen through the ſubſtance of bones, and among their plates. They are, indeed, no more than the channels by which the veſſels paſs into the bones; but the older anatomiſts imagined them to be ſtill more important, allowing the marrow to tranſude through all the ſubſtance of the bone, and keep it ſoft. Now this notion, of lubricating the earthy parts of a bone, like the common talk about fomentations to the internal parts of the body, is very mechanical, and very ignorant; for the internal parts of the body, are both hot and moiſt of themſelves, and neither heat nor moiſture can reach them from without: the bone is already fully watered with arteries; it is moiſt in itſelf, and

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* Theſe nails, which Gagliardi imagined, were no more than the little irregularities, riſings, and hollows of the adjoining plates, by which they are connected.

and cannot be further moiſtened nor lubricated, unleſs by a fuller and quicker circulation of its blood. It muſt be preſerved by that moiſture alone which exiſts in its ſubſtance, and muſt depend for its conſiſtence upon its own conſtitution; upon the due mixing up of its gluten and earth. Every part is preſerved in its due conſiſtence by the veſſels which form its ſubſiſtence; and I ſhould no more ſuppoſe fat neceſſary for preſerving the moiſtneſs of a bone, than for preventing brittleneſs in the eye. This marrow is, perhaps, more an accidental depoſition, than we at firſt ſight believe. We indeed find in it ſuch a regularity of ſtructure, as ſeems to indicate ſome very particular uſe; but we find exactly the ſame ſtructure in the common fat of the body. When, as we advance in years, more fat is depoſited in the omentum, or round the heart, we cannot entertain the abſurd notion of fat being needed in our old age, to lubricate the bowels or the heart; no more is the marrow (which is not found in the child), accumulated in old age for preventing brittleneſs of the bones.

The blood veſſels of a bone are large, in proportion to the maſs of the bone: For firſt one great trunk enters commonly about the middle of the bone, as in the thigh-bone, leg or arm, and is called the nutritious or medullary artery: it penetrates into the central cavity of the bone, ſpreads upwards and downwards, ſupplying all the ſubſtance of the bone itſelf, and giving thoſe delicate arteries which ſecrete the marrow. Other arteries enter from without, at the ſpongy ends of the bones, where the holes are not viſible only, but very large in the adult; particularly large arteries enter into to the heads of the bones, as of the ſhoulder, or of the thigh-bones; and there the perioſteum adheres very ſtrongly: and every where on its ſurface the bone is ſupplied by numerous veſſels from the perioſteum (and this ſeems, indeed, to be the chief uſe of that memberane); ſo that in tearing off the perioſteum, the ſurface of the membrane, and of the bone, are ſeen covered with bloody points; all the veſſels are conducted to the ſubſtance of the bone by its two membranes: the internal veſſels by the membrane which lines the cavity, and which is known by the abſurd name of internal perioſteum; the external one by the outer membrane, the proper or external perioſteum.

The internal perioſteum is that membrane which ſurrounds the marrow, and in the bags of which the marrow is formed and contained. It is more connected with the fat, than with the bone; and in animals, can be drawn out entire from the cavity of the bone; but its chief uſe is to conduct the veſſels which are to enter into the ſubſtance of the bone; and this connection and office is ſo eſſential to the life and health of the bone, that the ſpina ventoſa, or ſcrophulous bone, is merely a failure of the internal circulation, a total corruption of the marrow, and a conſequent loſs of the medullary veſſels; by which the whole bone dies, is thrown out by nature, or more frequently the limb muſt be cut off. The ſame effect is produced in our experiments, where, by piercing into the medullary cavity, and deſtroying the marrow, the ſhaft of the bone dies, while the heads and proceſſes live, merely becauſe they are ſupplied more fully by their external veſſels.

The perioſteum, which was once referred to the dura mater, is merely condenſed cellular ſubſtance; of which kind of matter we now trace many varied forms and uſes; for, ſo cloſe is the connection of the periosteum, tendons, ligaments, faſciæ, and burſæ, and ſo much are theſe parts alike in their nature and properties, that we reckon them but as varied forms of one common ſubſtance, ſerving for various uſes in different parts. The perioſteum conſiſts of many layers, accumulated and condenſed one above another: it adheres to the body of the bone by ſmall points or proceſſes, which dive into the ſubſtance of the outer layer, giving a firm adheſion to it, ſo that it may bear the pulling of the great tendons, which are fixed rather into the perioſteum, than into the bone *. It is alſo connected with the bone, by innumerable veſſels. It is not in itſelf vaſcular; but it is the medium by which veſſels are tranſmitted to the bone; and our injections do not eaſily colour the perioſteum itſelf, while they make the bone which belongs to it thoroughly red. The layers of the perioſteum neareſt to the bone, are condenſed and ſtrong, and take a ſtrong adheſion to the bone, that the veſſels may be tranſmitted ſafely, and the fibres of this inner layer follow the longitudinal directions of the bony fibres. The perioſteum is looſer in its texture outwardly, where it is reticulated and lax, changing imperceptibly into the common cellular ſubſtance. There the fibres of the perioſteum aſſume the directions

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* It would appear that the arteries are convertible through time into theſe tooth-like proceſſes, by which the perioſteum is fixed into the bone; for in youth, the veſſels are numerous, the adheſion ſlight, and the ſeparation bloody; but in the older ſubject, the ſeparation is more difficult, and leſs blood is ſeen.

tions of the muſcles, tendons, or other parts which run over it. The office of the perioſteum is not to generate bone; and therefore it adheres but ſlightly to the growing bone: It is to nouriſh the external plates; and therefore as the bone grows, and as the external plates are further removed from the medullary veſſels, the adheſion of the perioſteum becomes cloſer, its arteries are enlarged, and the dependence of the outer layers on the perioſteum is as well proved as the dependence of the body of the bone upon its medullary artery; for as piercing the medulla kills the whole bone, hurting the perioſteum kills the outer layers of the bone. Any accident which robs the bone of its perioſteum has this effect; accidental wounds of the perioſteum, deep ulcers of the ſoft parts, as on the ſhin, the beating of aneuriſms, the growth of tumors, the preſſure even of any external body, will, by hurting the perioſteum, cauſe exfoliation, which is, in plain terms, the death of the external layer, by the injury of the outward veſſels; and an active inflammation of the deeper layers, which being fully nouriſhed by the internal arteries, inflame, ſwell, become porous and ſpongy, form granulations, and theſe granulations puſh off the mortified plate, and form themſelves into new bone, which ſupplies its place.

The cartilages are alſo part of the living ſyſtem of the bone: and we ſee too well, in the queſtion of the bones themſelves, how unphiloſophical it muſt be, to deny organization and feeling to any part of the living body, however dead or inſulated it may appear; for every part has its degree of life: the eye, the ſkin, the fleſh, the tendons, and the bones, have ſucceſſive degrees of feeling and circulation. We ſee, that where even the loweſt of theſe, the bone, is deprived of its ſmall portion of life, it becomes a foreign body, and is thrown off from the healthy parts, as a gangrened limb is ſeparated from the ſound body ; and we ſpeak as familiarly of the death of a bone, as of the gangrene of ſoft parts. How, then, ſhould we deny organization and life to the cartilages, though ſurely, in reſpect of feeling, they muſt ſtand in the very laſt degree ?

The perioſteum goes from the bone over the ſurface of the cartilage alſo, where it is named perichondrium : It ſtill preſerves its own vaſcular nature ; the veſſels can be injected ; and it is not to be believed that the perichondrium has theſe veſſels, without communicating them to the cartilage to which it belongs. We ſee red arteries in the centre of an oſſifying cartilage ; and therefore we know that the trunk of the artery may be red, as in the oſſifying part of the cartilage, and yet the extremity of the ſame artery be pellucid, as in the unoſſified part. Since veſſels run through the cartilage to generate bone, we cannot, in reaſon, ſuppoſe that theſe veſſels are produced in the inſtant in which they appear : They had exiſted before ; they are but dilated now; the increaſing action dilates them, and the dilatation makes them red : this enables them to ſecrete bone, and, in many caſes, as in the accidental joint formed by a fracture ill cared for, we can, by paring the cartilage, ſet the veſſels free again, and make them begin to ſecrete.

Wherever we find a vaſcular membrane ſurrounding and nouriſhing any part, as the vitreous or cryſtalline humours in the eye, we muſt not ſuppoſe that ſuch are inſulated parts, maintained there by mere adheſion; but muſt conſider them as parts regularly organized, their vaſcular membrane being part of their living ſyſtem; and though the tranſparent humours of the eye, the cartilages and ligaments over all the body, and all the ſyſtem of the bones, have been conſidered as mere concretes, and inſulated parts, they are now known to be regular parts of the living whole. The cartilages have no very active circulation; it is ſuch as to keep them in life, but not ſo active as to endanger inflammation; in the continual ſhocks which they muſt endure, their feeling muſt be very obſcure, for feeling alſo would have been inconſiſtent with their offices, which is to cover and defend the bones; to yield to the weight of the body, and to reſtore themſelves when that weight is removed; to bear all the ſhocks of leaps or falls; to perform all the motions of the body, and the continual workings of the joints, where they rub, and even grate upon each other, without danger or pain.

We now underſtand the conſtitution of a bone, and can compare it fairly with the ſoft parts in vaſcularity, and in feeling; in quickneſs of abſorption; in the regular ſupply of blood neceſſary to the life of the bony ſyſtem; in the certain death of a bone, when deprived of blood by any injury of its marrow, or of its perioſteum, as a limb dies of gangrene, when its arteries are cut or tied; in the continual action of its abſorbents, forming its cavity, ſhaping its proceſſes and heads, keeping it ſound and in good health, and regulating the degree of bony matter, that the compoſition may neither be too brittle nor too ſoft. From this conſtitution of a bone, we can eaſily foreſee how the callus for uniting broken bones muſt be formed; not by a mere coagulation of extravaſated juice, but by a new organization reſembling the original bone.

The primordium of all the parts of the body is a thin gelatinous mucus, in which the forms of the parts are laid; and the preparation for healing wounds, and for every new part that needs to be formed, is a ſecretion of mucus which is ſoon animated by veſſels coming into it from every point. In every external wound, in every internal inflammation, wherever external parts are to be healed, or internal viſcera are about to adhere, a mucous matter is ſecreted, which ſerves as a bed or nidus, in which the veſſels ſpread from point to point, till the mucus is animalized and converted into a membrane: And thus the heart, the inteſtines, the teſticle, and other parts, adhere by inflammation to the coats which ſurround them, and which are naturally looſe. It is a mucus of the ſame form which unites the ends of a broken bone; and, by breaking the bones of animals, and attending to the progreſs of the callus, we find firſt a thin mucus; then that thickened into a tranſparent gelly; that gelly growing vaſcular, and theſe veſſels gradually depoſiting nuclei of oſſification in the centre of the maſs; and by madder, or by fine injections, we can make the gelly appear vaſcular, and the nuclei of oſſification quite red. The colours of our injections begin to tinge the cartilage as it begins to oſſify, and as ſoon as the oſſification is general, it receives a general tinge.

Now when we find the ſubſtance of the oldeſt bone thus full of veſſels, why ſhould we doubt of its being able, from its own peculiar veſſels, to heal a breach, or to repair any loſs? We have no reaſon to refer the generation of callus to the marrow, to the perioſteum, nor to the ſubſtance of the bone itſelf; for they are but parts of the common ſyſtem of a bone; and each part of this ſyſtem is of itſelf capable of regenerating the whole. How little the conſtitution of a bone has been underſtood, we may know from the ſtrange debates which have ſubſiſted ſo long about the proper organ for generating callus. Some have pronounced it to be the perioſteum; others the medullary veſſel, and internal membrane; others the ſubſtance of the bone itſelf: but I have been employed in explaining, that not only any part of the bone, perioſteum, or marrow, but even any artery in all the ſyſtem, may aſſume that action which generates bone. In the heat of this diſpute, one of the moſt eminent anatomiſts produced a diſeaſed bone, where a new bone had been formed ſurrounding a carious one, and the ſpoiled bone rattled within the cavity of the ſound one. Here we ſhould have been ready to pronounce, that bone could be formed by the perioſteum alone. But preſently another anatomiſt produced the very reverſe, viz. a ſound young bone, forming in the hollow cylinder of a bone which had been long dead; where, of courſe, the callous matter muſt have been poured into the empty cavity of the ſpoiled bone, from the ends which ſtill remained ſound, or muſt have been ſecreted by the medullary veſſels. But the truth is, that callus may be thus produced from any part of the ſyſtem of a bone; from its perioſteum, from its medulla, or from the ſubſtance of the bone itſelf. If we pierce the bone of any animal, and deſtroy the marrow, the old bone dies, and a new one is formed from the perioſteum: if we kill the creature ſoon, we find the new bone to be a mere ſecretion from the inner ſurface of the perioſteum; and if we wait the completion of the proceſs, we find the new bone beautiful, white, eaſily injected, and thick, looſe in its texture, and vaſcular and bloody, but ſtill firm enough for the animal to walk upon; and in the heart of it, we find the old bone dead and black. If we reverſe this operation, and deſtroy the perioſteum only, leaving the nutritious veſſels entire, then the new bone is formed freſh and vaſcular by the medullary veſſels, and the old one ſurrounds it quite black and dead; and in fractures of the patella, or knee-pan, where there are no medullary veſſels, the pieces are united by a callus, which is ſecreted from the veſſels of the bone itſelf.

The diſeaſes of the bones are the moſt frequent in ſurgery; and it is impoſſible to expreſs how much the ſurgeon is concerned in obtaining true ideas of the ſtructure, conſtitution, and diſeaſes of bones; how tedious, how painful, and how loathſome theſe diſeaſes are; how often the patient muſt loſe his limb, or endanger his life; how very uſeful art is; but, above all, what wonders nature daily performs in recovering bones from their diſeaſed ſtate.

CHAP. II.

OF THE SKULL IN GENERAL—THE BONES OF WHICH IT IS COMPOSED—THEIR TABLES—DIPLOE—SUTURES—THEIR ORIGINAL CONDITION, AND THEIR PERFECT FORM, REPRESENTED AND EXPLAINED.

While the bones in general ſerve as a baſis for the ſoft parts, and for ſupporting and directing the motions of the body, certain bones have a higher uſe in containing thoſe organs whoſe offices are the moſt eſſential to life. The ſkull defends the brain; the ribs and ſternum defend the heart and lungs; the ſpine contains that prolongation of the brain which gives out nerves to all the body: and the injuries of each of theſe are important in proportion to the value of thoſe parts which they contain.

How much the ſtudent is intereſted in obtaining a correct and perfect knowledge of the ſkull, he muſt learn by ſlow degrees. For the anatomy of the ſkull is not important in itſelf only; it provides for a more accurate knowledge of the brain; explains, in ſome degree, the organs of ſenſe; inſtructs us in all thoſe accidents of the head which are ſo often fatal, and ſo often require the boldeſt of all our operations. The marks which we take of the ſkull, record the entrance of arteries; the exit of veins and nerves; the places and uſes of thoſe muſcles which move the jaws, the throat, the ſpine. Indeed, in all the human body, there is not found ſo complicated and difficult a ſtudy, as this anatomy of the head; and if this fatiguing ſtudy can be at all relieved, it muſt be by firſt eſtabliſhing a very regular and orderly demonſtration of the ſkull.

For this end, we diſtinguiſh the face, where the irregular ſurface is compoſed of many ſmall bones, from the cranium or ſkull-cap, where a few broad and flat ſhaped bones form the covering of the brain. It is theſe chiefly which incloſe and defend the brain, which are expoſed to injuries, and are the ſubject of operation. In is theſe alſo that tranſmit the nerves. So that the cranium is equally the object of attention with the anatomiſt and with the ſurgeon.

All the bones of the cranium are of a flattened form, conſiſting of two tables, and an intermediate diploë, which anſwers to the cancelli of other bones. The tables of the ſkull are two flat and even plates of bone: the external is thought to be thicker, more ſpongy, leſs eaſily broken; the thinner table, again, is denſe, thin and brittle, very eaſily broken, and is ſometimes fractured, while the external table remains entire: Thence it is named tabula vitrea, or the glaſſy table. Theſe tables are parted from each other by the diſtance of a few lines*; and this ſpace is filled up with the diploë, or cancelli. The cancelli, or lattice work, is a net of membranes, covered with veſſels, partly for ſecreting marrow, and partly for nouriſhing the bone; and by the dura mater adhering to the internal ſurface, and ſending in arteries, which enter into the cancelli by paſſing through the ſubſtance of the bone, and by the pericranium covering the external plate, and giving veſſels from without, which alſo enter into the bone, the whole is connected into one ſyſtem of veſſels. The pericranium, dura mater, and ſkull, depend ſo entirely, one upon the other, and are ſo fairly parts of the ſame ſyſſem of veſſels, that an injury of the pericranium ſpoils the bone; ſeparates the dura mater, and cauſes effuſion upon the brain; a ſeparation of the dura mater is, in like manner, followed by ſeparation of the pericranium, which had been ſound and unhurt; and every diſeaſe of the cancelli, or ſubſtance of the bone, is communicated both ways; inward to the brain, ſo as to occaſion very imminent danger; outwards towards the integuments, ſo as to warn us that there is diſeaſe. The general thickneſs of the ſkull, and the natural order of two tables, and an intermediate diploë, is very regular, in all the upper parts of the head. In perforating with the trepan, we firſt cut with more labour, through the external table; when we arrive at the cancelli, there is leſs reſiſtance, the inſtrument moves with eaſe; there is a change of ſound, and blood comes from the tearing of theſe veſſels, which run in the cancelli, betwixt the tables of the ſkull. Surgeons thought themſelves ſo well aſſured of theſe

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* In anatomy there is occaſion in almoſt every deſcription, for a ſcale of ſmaller parts. The French divide their inch into twelve parts, each of

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of which is a line. The French line, or twelfth of an inch, is a meaſure which I ſhall often have occaſion to uſe.

theſe marks, that, it became a rule, to cut freely, and quickly, through the outer table; to expect the change of ſound, and the flow of blood, as marks of having reached the cancelli; and then to cut more deliberately, and ſlowly, through the inner table of the ſkull. But this ſhows an indiſcreet hurry, and unpardonable raſhneſs in operation. The patient, during this ſawing of the ſkull, is ſuffering neither danger nor pain; and many additional reaſons lead us to refuſe, altogether, this rule of practice. For the ſkull of a child conſiſts properly of one table only; or tables are not yet diſtinguiſhed, nor the cancelli formed: In youth, the ſkull has its proper arrangement of cancelli and tables; but ſtill, with ſuch irregularities, and exceptions, as make a hurried operation unſafe: In old age, the ſkull declines towards its original condition; the cancelli are obliterated; the tables approach each other, or are cloſed and condenſed into one; the ſkull becomes irregularly thick, at ſome points, and at others thin, or almoſt tranſparent:—ſo that there can hardly be named any period of life, in which this operation may be performed quickly, and ſafely at once. But, beſides this gradual progreſs of a bone, increaſing in thickneſs and regularity as life advances, and growing irregular and thinner in the decline of life, we find dangerous irregularities, even in younger ſkulls. There are often at uncertain diſtances, upon the internal ſurface of the ſkull, hollows and defects of the internal table, deep pits, or foveæ, as they are called, produced perhaps by the impreſſions of contorted veins. Theſe foveæ increaſe in ſize and in number as we decline in life; they are more frequent on the inner ſurfaces of the parietal and frontal bones; ſo that in thoſe places where the ſkull ſhould be moſt regular, we are never ſure, and muſt, even in the ſafeſt places, perforate gradually and ſlowly.

BONES.—The bones of which the cranium, or ſkull-cap, is formed, are eight in number. 1. The FRONTAL-BONE, or bone of the forehead, forms the upper and fore part of the head,—extends a little towards the temples, and forms alſo the upper part of the ſocket for the eye. 2. The PARIETAL BONES, are the two large and flat bones which form all the ſides, and upper part of the head; and are named parietalia, as they are the walls or ſides of the cranium. 3. The OS OCCIPITIS, is named from its forming all the occiput or back of the head; though much of this bone lies in the neck, and is hidden in the baſis of the ſkull. 4. The OSSA TEMPORUM form the lower parts of the ſides of the cranium: they are called temporal, from the hair that covers them being the firſt to turn grey, marking the time of life. 5. The OS ÆTHMOIDES, and, 6. the OS SPHENOIDES, are quite hidden in the baſis of the ſkull: they are very irregular and very difficultly deſcribed, or explained. The OS ÆTHMOIDES, is a ſmall ſquare bone, hollow, and with many cells in it: it hangs over the noſe, and conſtitutes a great and important part of that organ, and at the ſame time ſupports the brain. The olfactory nerves, by paſſing through it at many points, perforate it like a ſieve; and it takes its name from this perforated, or æthmoid plate. The OS SPHENOIDES, is larger and more irregular ſtill; placed further back; locked in betwixt the occipital and æthmoidal bones; lies over the top of the throat, ſo that its proceſſes form the back of the noſtrils and roof of the mouth; and it is ſo placed, as to ſupport the very centre of the brain, and tranſmit almoſt all its nerves.

SUTURES.—All theſe bones are joined together by ſeams, which, from their indented, or dove-tailed appearance, are named ſutures

1. The CORONAL SUTURE, is that which joins the frontal to the parietal bones; extends almoſt directly acroſs the head, from ear to ear; deſcends behind the eye, into the deep part of the temple; and there loſing its ſerrated appearance, becomes like the ſquamous or ſcaly ſuture, which joins the temporal bones. It is named coronal, becauſe the ancients wore their garlands on this part of the head. But the ſuture had been better intitled to this name, had it ſurrounded the head, than as it croſſes it.

2. The LAMBDOIDAL SUTURE, is that which joins the parietals, to the occipital bone. It begins behind the one ear, aſcends and arches over the occiput, and deſcends behind the other ear. It thus ſtrides over the occiput, in a form ſomewhat reſembling the letter lámbda (Δ) of the Greeks; whence its name.

3. The SAGITTAL SUTURE, joins the parietal bones to each other; runs on the very top of the head; extends forwards from the lambdoidal ſuture, till it touches, or ſometimes paſſes, the coronal ſuture; and from lying betwixt theſe two ſutures, like an arrow betwixt the ſtring and the bow, it has been named ſagittal.

4. The TEMPORAL SUTURES, join the temporal bones to the parietal, occipital, and frontal bones; the ſphenoid bone alſo enters into the temporal ſuture, juſt behind the eye. The temporal ſuture makes an arch

correſponding almoſt with the arch of the external ear; it meets the coronal ſuture, an inch before the ear, and the lambdoidal an inch behind it. This back part belongs as much to the occipital as to the temporal bone; and ſo has been named ſometimes additamentum ſuturæ lambdoidalis; ſometimes additamentum ſuturæ ſquamoſæ: for this temporal ſuture is, on account of the edge of the temporal and occipital bones being thin, and like ſcales of armour laid over each other, often named the ſquamous, or ſcaly ſuture.

5. The SPHENOIDAL and ÆTHMOIDAL SUTURES, are thoſe which ſurround the many irregular proceſſes of theſe two bones, and join them to each other, and to the reſt.

6. The TRANSVERSE SUTURE, is one which, running acroſs the face, and ſinking down into the orbits, joins the bones of the ſkull to the bones of the face; but with ſo many irregularities and interruptions, that the ſtudent will hardly recognize this as a ſuture.

7. The ZYGOMATIC SUTURE, is one which joins a branch of the temporal bone to a proceſs of the cheek-bone; forming an arch, zygoma, or yoke; but this ſuture has little extent; it is a ſerrated appearance at one ſingle point only.

To mark and know theſe ſutures, and to be able to trace them in imagination, upon the naked head, to foreſee where a ſuture will preſent, and how far it runs, may be a matter of great importance to the ſurgeon. Hippocrates, who has had more to praiſe his honeſty than to follow his example, acknowledges his having miſtaken a ſuture for a fracture of the ſkull; and ſince this warning, various contrivances and marks have been thought of, for preventing the like miſtake. It may be uſeful to remember that the ſuture has its ſerræ or indentations; is firmly covered by the pericranium; is cloſe, and does not bleed: but that a fiſſure, or fracture of the ſkull, runs in one direct line; is larger and broader at the place of the injury; grows ſmaller, as you recede from that, till it vaniſhes by its ſmallneſs; and that it always bleeds. Indeed the older ſurgeons, obſerving this, poured ink upon the ſuſpected part, which, if the ſkull was hurt, ſunk into the fiſſure, and made it black and viſible; but left the ſuture untouched. They alſo directed to make the patient take a wire betwixt his teeth, which being ſtruck, like the ſtring of an inſtrument, he would feel the twang produce a painful and peculiar ſenſation in the fractured part of the head. But after all theſe obſervations, in place of any true and certain marks, we find a number of accidents which may lead us into a miſtake.

Sutures cannot be diſtinguiſhed by their ſerræ or teeth, for the temporal ſutures want this common character, and rather reſemble capillary fractures of the ſkull *; nor even by their places, for we know that there are often inſulated bones (oſſa Wormiana) ſurrounded with peculiar joinings, which ſo derange the courſe of the common ſutures, that the joinings may be miſtaken for fractures of the ſkull, and the oſſa Wormiana for broken parts. Sometimes the ſquamous ſuture is double, with a large arch of bone intercepted betwixt the true and the falſe ſuture; or the ſagittal ſuture, deſcending beyond its uſual extent, and quite to the

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* Viz. Fractures as ſmall as a hair, thence named capillary.

the noſe, has been miſtaken for a fracture, and trepanned; and often in older ſkulls, the ſutures are entirely obliterated, all over the head. If the ſurgeon ſhould pour ink upon the ſkull, he would have reaſon to be aſhamed of an experiment ſo awkward and unſucceſsful; and for the old contrivance of a wire or cord held in the mouth, it cannot be done, ſince the patient is commonly inſenſible; and even, though leſs hurt, his feelings, after ſuch an accident, muſt be very confuſed; he muſt be too liable to be deceived; and we cannot, on ſuch ſlender evidence as this, perform ſo cruel an operation as cutting up the ſcalp, or ſo dangerous a one as the trepan.

For various reaſons we are careful to trace the bones from their original ſoft and griſtly ſtate, to their perfect condition of hard bone; and moſt of all, we are concerned to do ſo in the head, where, in childhood, the appearances are not ſingular and curious only, but have always been ſuppoſed to indicate ſome wiſe and uſeful purpoſe. It is in this original condition of the ſoft and growing bones, that anatomiſts have ſought to find a theory of the ſutures, how they are formed, and for what uſes. It has been remarked, that the number of pieces in the ſkull, is infinitely greater in the child than in the man. Theſe bones oſſifying from their centre towards their circumference, it happens, of courſe, that the fibres are cloſe at the centre of oſſification, and are more ſcattered at the extremities of the bone: when theſe ſcattered fibres of oppoſite bones meet, the growing fibres of one bone ſhoot into the interſtices of that which is oppoſed: The fibres ſtill puſh onwards, till they are ſtopped at laſt, and the perfect ſuture, or ſerrated line of union is formed.

In dilating this propoſition, we ſhould obſerve, that in the boy, all the bones in the head are membranous and imperfect. The membranous interſtices begin to be obliterated; the ſutures are beginning to cloſe; the diſtinction of two tables is not yet eſtabliſhed; the cancelli are not yet interpoſed betwixt the plates; the ſinuſes, or caverns of the bones, as in the forehead, the noſe, and the jaw are not formed; and each bone is not only incomplete towards its edges and ſutures, but conſiſts often of many parts. The OS FRONTIS is formed of two pieces, which meet by a membranous union in the middle of the bone. The OSSA PARIETALIA have one great and prominent point of oſſification in the very centre of each, from which diverging rays of oſſification extend towards the edges of the bone. The OS OCCIPITIS is formed in four diſtinct pieces; and the TEMPORAL BONES are ſo fairly divided into two, that their parts retain in the adult the diſtinct names of petrous and ſquamous bones. Although theſe are all the regular points of oſſification, yet ſometimes there occur ſmall and diſtinct points, which form irregular bones, uncertain in number or ſize, found chiefly in the lambdoid ſuture, ſometimes numerous and ſmall, more commonly they are few in number, and ſometimes of the full ſize of a crown, always diſtorting more or leſs the courſe of the ſuture, and being thus a ſubject of caution to the ſurgeon: Theſe are named OSSA TRIQUETRA, or, TRIANGULARIA, from their angular ſhape, or, WORMIANA, from Olaus Wormius, who obſerved them firſt. Now the os frontis being formed in two larger pieces; their edges meet early in life, and they form a ſuture ; but the bones continuing to grow, their oppoſite points force deeper and deeper into each other, till at laſt the ſuture is entirely obliterated, and the bones unite; and ſo this ſuture is found always in the child, ſeldom in the adult, almoſt never in old age. The occipital bone having four points, they are cloſer upon each other, they meet early, are ſoon united ; and, although very diſtinct in the child, no middle ſuture has ever been found in the adult, but always the four pieces are united into one firm and perfect bone. The parietal bones have their rays moſt of all ſcattered ; the rays of oſſification run out to a great diſtance, and diverge from one ſingle point, ſo that at their edges they are extremely looſe, and they never fail to form ſutures, by admitting into their interſtices the points and edges of the adjoining bones. The ſureſt and moſt conſtant ſutures are thoſe formed by the edges of the parietal bones ; the ſagittal in the middle, the coronal over the forehead, the lambdoidal behind, and the ſquamous ſuture, formed by their lower edges. But another phenomenon reſults at the ſame time, from this meeting and oppoſition of the fibres and interſtices of the growing bones : that when the oppoſite fibres meet too early, they are not fairly admitted into the open ſpaces of the oppoſite bone : but the fibres of each bone being directly oppoſed point to point, they both turn inwards, and form a ridge or ſpine, ſuch as is ſeen on the inner ſurfaces of the frontal and occipital bones. Such is the common theory, which I ſuſpect is imperfect, and which ſhould be received with ſome reſerve, for all the phenomena are not yet explained; we find each ſuture always in its appointed place; we find nothing like a ſuture formed betwixt the head and body of a long bone, though they are formed in diſtinct points, and are not united till after the years of manhood; we find no ſutures when bones are broken and reunited; when they have been ſpoiled, and are replaced; when a piece of ſpoiled bone has been cut away; or when a new ſhaft of a bone is formed by the ſecreting veſſels, and is united to the heads of the old bone. Theſe are accidents which hold us at leaſt in doubt.

It has been ſuppoſed, and with much appearance of truth, that the ſutures limit the extent of fractures; leave a free communication of the internal with the external parts; that they muſt ſerve as drains from the brain; that they are even capable of opening at times, ſo as to give relief and eaſe in the moſt dreadful diſeaſes of the head. But I fear we are not yet able to ſee the meaning of this peculiarity of ſtructure; for the ſutures are regular and uniform to a wonderful degree, while theſe uſes of them are far from being proved.

The ſutures ſurely were not intended by nature for limiting the extent of fractures: for fractures traverſe the ſkull in all directions; croſs the ſutures with eaſe; and very often paſſing all the ſutures, deſcend quite to the baſis of the ſkull, where we dare not follow them with the knife, nor apply the trepan. Indeed we do not even know that limiting the extent of fractures could be a gracious proviſion of nature, ſince it would rather appear by the common accidents, that the more eaſily the bone yields, the leſs is the injury to the

the brain; and that where the fracture is wide and large, the ſymptoms are milder, and the danger leſs.

Neither were they intended as drains; for ſurely it is a bold poſition to aſſume, that nature has carefully provided for our making iſſues upon the ſutures. When the original openneſs of the head and the membraneous condition of the ſutures was firſt obſerved, it was thought to be an obſervation of no ſmall importance. The ancients believed that the membranes of the brain came out by the ſutures, to form the pericranium, and going from that over the ſeveral joints, formed the perioſteum for all the bones. They ſaw a cloſe connection betwixt the external and internal membranes of the ſkull; and they thought that nature had intended there a freer communication, and an occaſional drain. They found the ſutures particularly wide and membraneous in a child, which they attributed to the watery ſtate of its brain, requiring a freer outlet than in the adult; and accordingly they named the opening of the child's head the bregma, fons, fontanelle, the fountain, by which they believed there was a continual exudation of moiſture from the brain.

We might have expected theſe notions to have vaniſhed with the doctrines of humours and revulſion which gave riſe to them; but both the doctrines, and the practice, have been revived of late years; and a ſurgeon of ſome eminence has been at pains to examine various ſkulls, trying to find which of all the ſutures remains longeſt open, and which ſhould form the readieſt and ſureſt drain; and after a curious examination of each, he decidedly condemns the fontanelle; finds the additamentum of the ſquamous ſuture always open, and expects this ſuperior advantage from placing his iſſues there, that he will command at once a drain both from the cerebellum and from the brain. But theſe notions, ſo much cheriſhed by the ancients, of derivation and revulſion, of ſerous humours falling upon the brain, of drains of pituita by the noſe and through the ſutures, have been long forgotten, and have not been effectually revived by this attempt.

It cannot be denied, that, in ſome inſtances, the ſutures have continued quite open in perſons grown in years, or have opened after a moſt wonderful manner, in ſome diſeaſes of the head.

A young man having been brought into an hoſpital ill of a fever, the phyſicians obſerved with ſurpriſe a very ſtrong pulſation behind the ear: Upon applying the finger, a ſtrong beating was felt; the part was ſoft and yielding; and upon opening his head, after death, there was found a large membraneous ſpace. Diemorbrock found the fontanelle open in a woman of forty years of age. Bauhin ſays, that in his own wife, twenty-ſix years of age, the ſutures were not yet cloſed.

This fontanelle, or opening at the meeting of the coronal and ſagittal ſutures, was once thought to be a ſure mark for the accoucheur to judge by, both of the life of the child, and of the direction in which its head preſented. It is large and ſoft in a child; and the good women lay a piece of firm cloth upon it, and defend it with particular care. It begins to contract from the time of birth; and in the ſecond and third year, it is entirely cloſed. Its cloſing is delayed by weakneſs, ſcrofulous complaints, and indeed by any lingering diſeaſe; it cloſes very late in rickets; and in hydrocephalic children the bones never cloſe, but continue ſoft, yield to the watery ſwelling of the brain, and ſeparate in a wonderful degree, ſo as to hold ten or twelve pounds.

As the ſutures continue open in a hydrocephalic child, they are ſaid to open again in the few inſtances where adults are ſeized with the ſame diſeaſe. We are told that it opens in thoſe dreadful headaches which are ſometimes fatal, and that the celebrated Paſchal having died after terrible torments, was found to have the ſutures opened again. It is even ſaid that they open during diſeaſe, and cloſe after the cure: "That a "man of forty years of age being in the dog-days ſeized with a raging fever, delirium, watching, and dreadful pains of the head, his ſutures opened on the ſeventh day, were as wide as in a child; not only ſo as "to be diſtinguiſhed by the finger, but that the attendants could ſee the pulſations of the brain: the "fever, after ſome time, abated; the pains ceaſed; the "ſutures cloſed, and this man lived many years in perfect health." So Hildanus reports the caſe; and he alſo ſays, in another inſtance, that the ſutures had parted in a violent hemicrania, with an audible noiſe.

Yet, if this were a regular deſign of nature, the relief ſhould be perfect; perhaps the opening of the ſutures ſhould be more eaſy, and the accident almoſt as common as diſeaſes of the head: or perhaps it had been the more merciful order, to have determined a quick and ſudden period for ſuch dreadful and incurable diſeaſes as theſe.

The ſutures of the cranium are accidental merely, and of little uſe. The reſult, perhaps, of this well known law, that nature ſeeks to facilitate oſſification, by beginning the proceſs in many points; and ſhe eſtabliſhes as many diſtinct points, in healing a broken limb as in forming the ſkull. But however they may be formed, their uſes cannot be of that importance which has been ſuppoſed; for there are twenty ſeparate bones, and twenty ſutures in the face, where they can neither ſtop fractures, nor ſerve as drains, nor open ſo as to give relief.

But if the ſutures of the cranium have any thing peculiar and different from thoſe of the face, in that, perhaps, their peculiar uſes may be found. We cannot paſs unnoticed their looſeneſs and flexibility in the new born child; how wonderfully the head of the child is increaſed in length, and reduced in breadth in the time of delivery, and how much this conduces to an eaſy and happy labour.

The moſt eminent anatomiſts have condeſcended to remark, that in the various nations of Europe the head has various forms; which they aſcribe to ſo ſlight a preſſure as that which dreſs, or even the poſture of the head, might produce. But how very far Veſalius was deceived in calculating thus, is eaſily proved. The Turks, ſays he, have their heads flattened by wearing the turban. But the turban is an Eaſtern dreſs: The Turks or Tartars are a northern people, who aſſume this dreſs only when conqueſt brings them into a warmer climate; and the prominent cheek-bones, parted eyes, and flat heads, continue in the Tartars, who have but newly aſſumed the turban, while the conquered nations who have worn it long, are diſtinguiſhed by their regular and beautiful features. Perhaps by contrivance and force, we may diſtort the head of a child; and we may almoſt believe what is told of the negroes of the Caribbee iſlands, who had contrived, by preſſure, to flatten their childrens heads, that their race might be in future diſtinguiſhed from thoſe who had ſubmitted to the Spaniſh yoke; or of what is told ſo often of eaſtern nations, that they ſometimes mould the heads of children into monſtrous and uncouth forms, to extort charity, or as an act of religion. Were I to aſſign a reaſon for the flexible bones, and wide ſutures, and the yielding condition of the head of the child, I ſhould ſay that it were meant by nature to ſtand in the place of that ſeparation of the bones of the pelvis which has been ſuppoſed, but which cannot exiſt; for the child's head is moulded with little injury, is evolved again without help; and it ſeems a proviſion of nature, ſince the child ſcarcely feels the change: but no woman has been known to have the joinings of the pelvis relaxed or diſſolved without pain and danger, confinement for many months, a temporary lameneſs; and ſometimes ſhe is rendered unable for life.

CHAP. III.

DESCRIPTION OF THE INDIVIDUAL BONES OF THE SKULL.

OS FRONTIS. This bone is compared with a clamſhell. It is of a ſemicircular ſhape, hollowed like a ſhell, and very equal in its thickneſs. It is marked on the inſide by a ſpine, or prominent line, which divides the hollow of the bone into two equal parts, and gives riſe to a membranous partition, which divides and ſupports the hemiſpheres of the brain. It is marked on its external ſurface by thoſe high ridges on which the eyebrows are placed; and by two prominences, under which are hollow caverns, named the SINUSES (or cavities) of the frontal bone. It is irregular only in its orbitary plates, which are the two thin and delicate lamellæ that depart from the general direction of the bone, and ſtand out horizontally, ſo as to form a part of the ſocket for the eye, or, as it were, a roof defending the upper part of the eye, and a floor for ſupporting the lower part of the brain; and theſe two orbitary plates leave an open ſpace, in which is incaſed the chief part of the æthmoid bone.

The firſt point to be remarked, is the SUPERCILIARY

RIDGE, on which the eyebrows are placed: It is a prominent arched line, correſponding in ſize and length with the eyebrow which it ſupports. It is the origin of the frontal muſcles. In this line, the integuments adhere very ſtrongly, by many arteries which perforate the bone, and which are properly the nutritious arteries of this part of the bone; and we find all over the ſuperciliary ridge many ſmall holes through which theſe arteries had paſſed. Among theſe, there is one hole which is larger, and which is diſtinguiſhed from the reſt; for its uſe is not like the others to tranſmit arteries to the bone, but to give paſſage to a ſmall artery which comes out from the orbit, to mount over the forehead. Sometimes this artery turns freely over the border of the orbit, and makes no mark, or but a ſlight one: often lying cloſer upon the bone, it forms a notch; but moſt commonly, in place of turning fairly over the edge of the orbit, it paſſes obliquely through the ſuperciliary ridge, and, by perforating the bone, makes a hole. This hole is named the SUPERCILIARY HOLE. The artery which comes from the eye to go out upon the forehead is named, where it paſſes the ridge, the ſuperciliary artery; and higher up upon the forehead, the frontal artery. It eſtabliſhes a communication betwixt the internal arteries of the eye, and the external arteries of the forehead and temple; and it carries along with it a ſmall nerve from the eye, which, going alſo out upon the forehead, is named the ſuperciliary or frontal nerve. We are always warned of the danger of wounding arteries where they paſs through bones; and ſtrange ſtories are told of the terrible bleedings which have ariſen from this artery when wounded near its hole; and of the convulſions, palſies, and loſs of ſight, which have ariſen from the accidents, wounds, or lacerations of this frontal nerve: Theſe ſtories are delivered on authorities which we dare not refuſe, and yet they are ſuch as we cannot eaſily believe.

This orbitary, or ſuperciliary ridge, ends by two proceſſes, which, forming the angles of the eye, are named the ANGULAR PROCESSES. The frontal bone has therefore four angular proceſſes: 1. The two internal angular proceſſes, forming the internal angles of the eyes; and, 2. The two external angular proceſſes which form the external angles of each eye. Behind each external angular proceſs, the bone lies flat, and ſunk into a hollow which lodges the temporal muſcles; and betwixt the two internal angular proceſſes there is the NASAL POINT OR PROCESS. This naſal proceſs is a ſmall ſharp projecting point, which is exactly in the middle of the bone, occupying that ſpace which is betwixt the two internal angular proceſſes. It is very irregular and rough all round its root, for ſupporting the two ſmall naſal bones; and this gives them a firm ſeat, and ſuch a hold upon the root of the forehead, that they will be ſooner broken than diſplaced.

At the inner end of the ſuperciliary ridge, is that bump which marks the place of the frontal ſinuſes: it alſo in ſome degree indicates their ſize; for where this riſing is not found, the ſinuſes are awanting, or are very ſmall; but this is no ſure, nor abſolute mark of the preſence of theſe ſinuſes, which often, in the flatteſt foreheads, are not entirely awanting.

The ſinuſes * of the os frontis are two in number, one on either ſide above the root of the noſe: They are formed by a receding of the two tables of the ſkull from each other: they are formed at firſt with the common cancelli, and at firſt they reſemble the common cancelli, as if they were only larger cells: gradually they enlarge into two diſtinct cavities, often of very conſiderable ſize; going down into the orbitary plate, or ſidewiſe into the orbitary ridge, or upwards through one half of the frontal bone; and Ruiſch had, in a giantefs (puella gigantica), ſeen them paſs the coronal ſuture, and extend ſome way into the parietal bones.

The ſinuſes of either ſide are ſeparated by a partition; but ſtill they communicate by a ſmall hole: ſometimes the partition is almoſt awanting, and there are only croſſings of the common lamellated ſubſtance; and though the communication with one another is not always found, they never fail to communicate with the noſe. This indeed ſeems to be their chief uſe; for the frontal ſinuſes are the beginning of a great train of cells, which, commencing thus in the frontal bone, extend through the æthmoidal, ſphenoidal and maxillary bones, ſo as to form an organ of great extent and

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* The word Sinus is uſed in two ſenſes: we call the cavities or cells within the ſubſtance of a bone, the ſinuſes of that bone; as the ſinuſes of the forehead, of the ſphenoid, æthmoid, or maxillary bones: we call alſo certain great veins by the ſame name of ſinuſes: Thus the great veins being enlarged where they approach the heart, and the veins being particularly large in the brain and the womb, we call them the ſinuſes of the heart, of the brain, and of the womb.

and uſe belonging to the noſe; but perhaps not ſo much for extending the organ of ſmelling, as for making a more ſonorous voice. For we have no proof that the ſinuſes are part of the organ of ſmell; unleſs we ſhould accept of this as a proof, that, by the ſmelling of ſtrong volatiles, pain ſhoots upwards into the forehead; though, by this rule, the eyes ſhould be alſo a part of the ſame organ, ſince, from the ſame cauſe, they are pained, and tears begin to flow: but we do know that the ſinuſes belong to the voice, and raiſe its tone, for we feel the trembling note reſound through all theſe cells; ſo that the voice is ſonorous while they are free; is damped when the ſinuſes are oppreſſed by their membranes being thickened by cold; or is almoſt ſuppreſſed when the ſinuſes are entirely cloſed; or when, by venereal ulcers, the curtain of the palate is conſumed, no part of the voice paſſing upwards into the noſe, it is almoſt loſt.

This has given riſe to a very common miſtake: that as theſe ſinuſes are awanting in the child whoſe forehead is flat, as they enlarge gradually, and are fully formed about the fifteenth year, the vox rauca, the breaking of the voice, which is obſerved about that time, muſt be owing to the evolution of theſe cells. But the female voice does not undergo the ſame change by the evolution of theſe cells; and caſtration, which ſurely can have no effect on theſe cavities, keeps down the eunuch's to the treble key of the female voice. The miſtake lies in ſuppoſing theſe cavities to raiſe the tone or note in which we ſpeak, while they only add clearneſs and ſtrength:

The membrane which lines theſe cavities is thin, and exquiſitely ſenſible, and is a continuation of the common membrane of the throat and noſe. A thin humour is poured out upon its ſurface to moiſten it and keep it right. This the ancients did not conſider as merely a lubricating fluid, but as a purgation of the brain, drawn from the pituitary gland; which could not be diminiſhed without danger, and which it was often of conſequence to promote.

Theſe ſinuſes are ſubject to one accident chiefly, viz. inſects, which neſtle there, and produce inconceivable diſtreſs; and it is particular, that inſects more frequently lodge in the frontal ſinuſes, than in the cavities of any of the other bones. In ſheep and dogs, ſuch inſects are very frequent, as, in ſeeking their food, they carry their noſe upon the ground; and it has been proved, or almoſt proved, that in man they ariſe from a like cauſe. Indeed what can we ſuppoſe, but that they get there by chance? Thus, a man having ſlept in barns, was afflicted with dreadful diſorders in the forehead, which were relieved upon diſcharging from the noſe a worm of that kind which is peculiar to ſpoiling corn; while others have had the complaint, by ſleeping upon the graſs. But there is ſomething very particular in this, that by far the greater number of theſe worms have been of the centipede kind; generally long, an inch in length, with one hundred, or, according to Linnæus, one hundred and twelve feet, and not unfrequently covered with hair. There are reports which ſeem to prove, that ſome have died of this complaint, and in a very miſerable way. In many caſes it has been attended with delirium; and in almoſt every inſtance it has continued for years. No wonder, then, that the trepanning of theſe ſinuſes has been often propoſed; but I have never read of a well marked caſe, ſo that we could be aſſured beforehand of finding worms: They have, in moſt caſes, been diſcovered rather by chance. The patient might be relieved on eaſier terms, by the injection of aloes, aſſafœtida, myrrh, the uſe of ſnuff or ſmoaking, and preſſing the fumes upwards into the noſe. Much ſhould be tried, before undertaking a dangerous operation on ſuch ſlender proofs.

It may be right, in caſes of fractures, to decline applying the trepan above the ſinuſes, unleſs a fracture cannot be raiſed in any eaſier way; and we muſt be, eſpecially, careful to diſtinguiſh a fracture of the outer table only, from entire fractures of this bone. For Palfin ſays, that the outer table being broken, and the natural mucus of the ſinus being corrupted and flowing out, has been miſtaken for the ſubſtance of the brain itſelf. And Parée, who firſt gives this caution, affirms, "that he had ſeen ſurgeons guilty of this miſ-"take, applying the trepan, and ſo killing their un-"happy patients."

The SPINE OR RIDGE which runs upon the internal ſurface of the frontal bone, is to be obſerved, as it gives a firm hold to the falx, or that perpendicular membrane, which, running in the middle of the head, divides and ſupports the brain. This is more or leſs prominent in different ſkulls, and according to the age. The ſpine is more prominent at its root; but as it advances up the forehead, it decreaſes, and often ends in a groove. The ſpine gives firm hold for the falx, and the groove lodges the great longitudinal ſinus, or, in other words, the great vein of the brain, which runs along the head, in the courſe of the perpendicular partition, or falx. At the root of this ſpine, there is a ſmall blind hole, which will juſt admit a pin; it is named blind, becauſe it does not paſs quite through the bone, and the beginning of the falx, dipping down into this hole, gets a firmer hold. The ancients, thinking that this hole deſcended through both tables into the noſe, believed, that the dangerous and ungovernable bleedings at the noſe, muſt be through this hole, and from the fore end, or beginning of the longitudinal ſinus.

The ORBITARY PROCESS is the laſt remarkable point of the frontal bone. The orbitary proceſſes are two thin plates, departing from the general direction of the bone, and ſtanding inwards at right angles: They cover the eye, and ſupport the brain. By the continual rolling of the eye, and the preſſure of the brain, they are extremely thin and tranſparent; the rolling of the eye makes them exquiſitely ſmooth below, and on their upper ſurfaces they are impreſſed with the frequent convolutions of the brain: ſo that a wound through the eye endangers more than the eye; for it paſſes eaſily forward into the brain, and is inſtantly fatal: it is the aim of the fencer; and we have known, in this country, a young man killed by the puſh of a foil which had loſt its guard.

Upon the orbitary plate, and juſt under the ſuperciliary ridge, there are two depreſſions in the ſocket of each eye: the one is very ſmall, and deeper at the inner corner of the eye, under the orbitary hole, which is the mark of the ſmall cartilaginous pulley, in which the tendon of one of the muſcles of the eye plays; the other, a more gentle and diffuſed hollow, lies under the external angular proceſs, is not deep, but is wide enough to receive the point of a finger, and is the place where the lachrymal gland lies; that gland which ſecretes the tears, and keeps the eye moiſt.

OSSA PARIETALIA.—The parietal bones form by much the greater ſhare of the cranium: they are more expoſed than any others; are the moſt frequently broken, and the moſt eaſily trepanned; for the parietal bones are more uniform in their thickneſs, and more regular in their two tables and diploë, than any others. But the accidental varieties of pits and depreſſions are very frequent in them; and the ſinus or great vein, and the artery which belongs to the membranes of the brain, both make their chief impreſſions upon this bone.

Each parietal bone is very nearly of a ſquare form, ſurrounded by deeply ſerrated edges, which unite them with each other, and with the occipital and frontal bones. All the corners of this bone are obtuſe, except that one which lies in the temple, and which, running out to a greater length than the other corners, is ſometimes named the SPINOUS PROCESS of the parietal bone; though there can be no true proceſs in a bone ſo regular and flat. The lower edge of the bone is a neat concave ſemicircle, which joins the parietal to the temporal bone; and the edge of each is ſo flaunted off, that the edge of the temporal overlaps the edge of the parietal, with a thin ſcale, forming the ſquamous ſuture. About an inch above the ſquamous ſuture, there is a ſemicircular ridge, where the bone is particularly white and hard; and rays extend downwards from this, converging towards the jugum, or arch of the temple. The white ſemicircular line repreſents the origin of the temporal muſcle; and the converging lines expreſs the manner in which the fibres of the muſcle are gathered into a ſmaller compaſs, to paſs under the jugum. The ſagittal ſuture, or meeting of the two parietals, is marked on the inſide with a groove as big as the finger, which holds the longitudinal ſinus, or great vein of the brain: but the groove is not ſo diſtinctly ſeen, unleſs the two bones be put together; for one half of this flat groove belongs to each bone.

The great artery of the dura mater touches this bone at that angle of it which lies in the temple. It traverſes the bone from corner to corner, ſpreading from the firſt point, like the branches of a tree: it beats deep into the bone where it firſt touches it; but where it expands into branches, its impreſſions are very ſlight; commonly it makes a groove only, but ſometimes it is entirely buried in the bone; ſo that at the lower corner of the parietal bone we cannot eſcape cutting this veſſel, if we are forced to operate with the trepan.

There is but one hole in the parietal bone: it is ſmall and round, is within one inch of the meeting of the lambdoidal and ſagittal ſutures, and gives paſſage to a ſmall external vein, which goes inwards to the ſinus; and to a ſmall artery which goes alſo inwards to the dura mater, or rather to the falx.

The meeting of the frontal and parietal bones, being imperfect in the child, leaves that membraneous interſtice, which by ſome is named folium or folliolum, from its reſembling a trefoil leaf; and was named by the ancients hypothetically, bregma, fons *, or fountain; they thinking it a drain of moiſture from the brain; and ſo the parietal bones are named oſſa bregmatis.

OS OCCIPITIS.—This bone has alſo the names of os memoriæ, and os nervoſum. It is the thickeſt of the cranial bones, but is the leaſt regular in its thickneſs, being tranſparent in ſome places, and in others ſwelling into ridges of very firm bone. It gives origin or inſertion to many of the great muſcles, which move the head and neck; it ſupports the back part of the brain; contains the cerebellum or leſſer brain; tranſmits the ſpinal marrow, and is marked with the conflux of the chief ſinuſes, or great veins of the brain.

The EXTERNAL SURFACE is exceedingly irregular, by the impreſſions of the great muſcles of the neck: For firſt the trapezius and complexus, two great external muſcles of the neck and head, have their chief hold upon the occipital bone, by which there is formed one great TRANSVERSE SPINE. Below theſe again, the recti muſcles, two ſmall and deep muſcles of the head and neck, make another tranſverſe ſpine below the firſt: ſo that there is a double transverſe ſpine; and the interſtice betwixt the muſcles of the oppoſite ſides leaves, of courſe, a prominent ridge or ſpine, which, running the

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* The word pulſatilis, or fons pulſatilis, or beating fountain, was added, becauſe we feel the beating of the arteries of the brain there.

from above downwards, croſſes the firſt ridges, and makes a croſs called the CRUCIAL SPINE; and in a ſtrong man advanced in years, where the ridges and hollows are ſtrongly marked, the point where theſe ridges croſs, is ſo very prominent, as to be named the POSTERIOR TUBEROSITY of the occipital bone.

The INTERNAL SURFACE. Oppoſite to theſe ridges, there are ſimilar crucial ridges within; but more regular, ſmooth, and equal, and making only one tranſverſe line. The TENTORIUM CEREBELLO-SUPER-EXTENSUM, is a diaphragm or tranſverſe partition, which croſſes the ſkull at its back part; cuts off from the reſt of the cranium the hollow of the occipital bone; appropriates that cavity for the cerebellum, and defends the cerebellum from the weight and preſſure of the brain. This tentorium, or tranſverſe membrane, is attached to the GREAT INTERNAL RIDGE of the occipital bone. In the angle where this membrane is fixed to the ridge, lies the great ſinus or vein; which is called longitudinal ſinus, while it is running along the head; but the ſame ſinus, dividing in the back of the head, into two great branches, changes its name with its direction; and the forkings of the veſſel are named the right and left lateral ſinuſes, which go down through the baſis of the ſkull; and being continued down the neck, are there named the great or internal jugular veins. This forking of the longitudinal, into the lateral ſinuſes, makes a TRIANGULAR or TRIPOD-LIKE GROOVE, which follows the internal ridges of the occipital bone: and above and below the tranſverſe ridge, there are formed four plain and ſmooth hollows. The two upper ones are above the tentorium, and contain the backmoſt

moſt lobes of the brain; the two lower ones are under the tentorium, and hold the lobes of the cerebellum or little brain.

PROCESSES. The proceſſes or projections of the occipital bone are few and ſimple. 1. There is a part of the bone which runs forward from the place of the foramen magnum; lies in the very centre of the baſe of the ſkull; and joins the occipital to the ſphenoidal bone; and which, both on account of its place (wedged in the baſis of the ſkull), and of its ſhape, which is rather ſmall, and ſomewhat of the form of a wedge, is named the CUNEIFORM, or WEDGE-LIKE PROCESS of the occipital bone. And, 2. There are two ſmall oval proceſſes, or button-like projections, which ſtand off from the ſide, or rather from the forepart of the foramen magnum, or great hole, and which, being lodged in joints belonging to the upper bone of the neck, form the hinge on which the head moves. Theſe two proceſſes are named the CONDYLES of the occipital bone. They are not very prominent, but rather flattened; are of an oval form, and have their fore-ends turned a little towards each other; ſo that by this joint the head moves directly backwards or forwards, but cannot turn or roll. The turning motions are performed chiefly by the firſt bones of the neck. Round the root of each condyle, there is a roughneſs, which ſhows where the ligament ties this ſmall point to the correſponding bone of the neck.

HOLES.—1. Theſe condyles ſtand juſt on the edge of the FORAMEN MAGNUM, or great hole of the head, which tranſmits the ſpinal marrow, or continuation of the brain; and the edges of this hole (which is almoſt a regular circle) are turned and ſmoothed; a little thicker at the lip, and having a roughneſs behind that, giving a firm hold to a ligament, which, departing from this hole, goes down through the whole cavity of the ſpine, forming at once a ſheath for the ſpinal marrow, and a ligament for each individual bone. There paſſes down through this great hole the ſpinal marrow, and the vertebral vein. There come up through it the vertebral arteries, which are of great importance and ſize; and a ſmall nerve, which, from its coming backwards from the ſpine to aſſiſt certain nerves of the brain, is named the ſpinal acceſſary nerve.

2. The ſecond hole is placed a little behind the ring of the foramen magnum, and juſt at the root of either condyle, is round, and large, eaſily found, and ſometimes it is double; it tranſmits the ninth pair, or great lingual nerve.

3. There is another hole ſmaller, and leſs regular than this laſt. It is exactly behind the condyle, while the lingual hole is before it. It is for permitting a ſmall vein, the cervical vein of the neck, to enter and drop its blood into the great lateral ſinus; but often it is not formed, and this trifling vein gets in by the great occipital hole.

4. We ſhall deſcribe with the temporal bone that wide hole which is common to the temporal and occipital bones, and which tranſmits the great lateral ſinus.

OS TEMPORIS.—The temporal bone is, in the child, two bones; which retain their original names of pars petroſa and pars ſquamoſa. The whole bone is very irregular in its thickneſs, and hollows, and proceſſes. The PARS SQUAMOSA is a thin or ſcaly part; riſes like a ſhell over the lower part of the parietal bone, and is ſmoothed and flattened by the rubbing of the temporal muſcle. The PARS PETROSA, often named OS LAPIDOSUM, or ſtony bone, is hard, irregular, rocky; juts inwards towards the baſis of the ſkull; contains the organ of hearing, and, of courſe, receives and tranſmits all the nerves which are connected with the ear. There is a third portion of this bone, viz. the occipital angle, which is thick and hard; is divided into cells, and forms thoſe caverns which are ſuppoſed to be chiefly uſeful in reverberating the ſound.

The ſquamous part is grooved, to make the ſquamous future; is ſcolloped or fringed; and exceedingly thin on its edge; it is radiated, in conſequence of its original oſſification ſhooting out in rays. The petrous part again is triangular, unequal by the cavities of the ear; it has a very hard, ſhining, poliſhed like ſurface; exceeded in hardneſs by nothing but the enamel of the teeth. Where it projects into the baſe, it has ſeveral open points, which are filled up with cartilaginous or ligamentous ſubſtance; and its occipital angle is connected with the other bones by the additamentum ſuturæ ſquamoſæ.

PROCESSES. 1. The ZYGOMATIC PROCESS riſes broad and flat before the ear; grows gradually ſmaller as it ſtretches forward to reach the cheek-bone: forms with a proceſs of that bone the zygoma, yoke, or arch of the temple, under which the temporal muſcle plays.

The temporal muſcle is ſtrengthened by a firm covering of tendon, which ſtretches from the upper edge of this zygoma to the white line on the parietal bone; and ſeveral muſcles of the face ariſe from the lower edge of the zygoma, particularly one named maſſeter, which moves the jaw; and one named zygomaticus, or diſtortor oris, becauſe it draws the angle of the mouth. The zygomatic proceſs is united by a ſhort ſuture to the cheek-bone.

2. The STYLOID PROCESS, is ſo named from a ſlight reſemblance to the ſtylus, or point with which the ancients engraved their writings on tables of wax. It is cartilaginous long after birth; even in the adult, it is not completely formed; it is exceedingly delicate and ſmall; and when its cartilaginous point is fairly oſſified, as in old men, it is ſometimes two inches long. It ſtands obliquely out from the baſis of the head, and is behind the jaw; ſo that it gives convenient origin to a ligament which goes downwards to ſupport the os hyoides, or bone of the tongue; and it is the origin of many curious muſcles, chiefly of the throat and jaws. One ſlender muſcle going downwards from the ſtyloid proceſs, and expanding over the pharynx, is called ſtylo-pharyngeus; one going to the os hyoides, is the ſtylo-hyoideus; one going to the tongue, is the ſtylo-gloſſus; and ſince the proceſs is above and behind theſe parts, the muſcles muſt all pull backwards and upwards, raiſing according to their inſertions, one the pharynx, another the os hyoides, another the tongue.

3. The VAGINAL PROCESS will not be eaſily found, nor acknowledged as a proceſs; for it is only a ſmall riſing of a ridge of the bone, with a rough and bro-

ken-like edge, on the middle of which the ſtyloid proceſs ſtands: it is, in ſhort, the root of the ſtyloid proceſs; and anatomiſts have choſen to obſerve it, though it gives origin to no particular part; and they have named it vaginalis, as if it reſembled a ſheath for the ſtyloid proceſs.

4. The MASTOID OF MAMMILLARY PROCESS, is a conical nipple-like bump, like the point of the thumb; it projects from under the ear, and is eaſily felt with the finger without; it is hollow, with many cells which enlarge the tympanum, or firſt cavity of the ear, and are thought to reverberate and ſtrengthen the ſound. Under its root, there is a deep and rough rut which gives a firm hold to the firſt belly of the digaſtric muſcle; and the point or nipple of this proceſs is the point into which the maſtoid muſcle is inſerted from before, and the complexus, obliquus, and trachelo-maſtoidæus muſcles from behind. It has been propoſed of late years, that, in certain caſes of deafneſs, we ſhould open this part with the trepan.

5. The AUDITORY PROCESS is juſt the outer margin of the hole of the ear. It is in a child a diſtinct ring, which is laid upon the reſt of the bone. The membrane of the ear is extended upon this ring, like the head of a tambour upon its hoop, whence this is named the circle of the tambour by the French, and by us the drum of the ear. In the adult, this ring is fairly united to the bone, and is named the proceſſus auditorius; and may be defined a circle, or ring of bone, with a rough irregular edge; the drum or membrane of the ear is extended upon it, and the cartilaginous tube of the ear is fixed to it; and this ring occupies

the ſpace from the root of the mammillary to the root of the zygomatic proceſs.

HOLES. The temporal bone is perforated with many holes, each of which relates to the organ of hearing; ſome for permitting nerves to enter; others for letting them out; and others for the free paſſage of air to the internal ear.

1. The MEATUS AUDITORIUS EXTERNUS (the circle of which has been deſcribed), is covered with the membrane of the drum, and communicates the vibratory motion of the air for moving and exciting the internal organs.

2. The MEATUS AUDITORIUS INTERNUS, is that hole by which the auditory nerves have acceſs to the ear. It is a very large hole, ſeated upon the back of the pars petroſa, which is of a triangular form. The hole is at firſt large, ſmooth, almoſt a regular circle, with a ſort of round lip. Within this there are ſeen many ſmall holes, the meaning of which is this: The auditory nerve is double from its very origin in the brain: it conſiſts, in fact, of two diſtinct nerves, the portio dura, and the portio mollis. The portio mollis is a large ſoft and delicate nerve, which conſtitutes the true organ of hearing; and when it is admitted into the ear, it is expanded into a thin web which ſpreads over all the cavities of the ear, as the cochlæa, ſemicircular canals, &c. The portio dura, the ſmaller part of the nerve, paſſes indeed through the ear, but it is quite a foreign nerve; it is not diſtributed within the ear; it keeps the form of a diſtinct cord, and paſſing through the temporal bone, it comes out upon the cheek, where it is expanded; ſo that the portio

dura is a nerve of the face, paſſing through the ear, but forming no part of that organ. Thus the two nerves, the portio dura and the portio mollis, enter together; they fill the greater hole, and then they part; the portio dura, entering by one diſtinct hole, takes its courſe along a diſtinct canal, the aqueduct of Fallopius, from which it comes out upon the cheek; while the portio mollis, entering by many ſmaller holes into the cochlæa, ſemicircular canals, and other internal parts of the ear, is expanded in theſe cavities to form the proper organ of hearing.

3. There is upon the fore part of the petrous bone a ſmall hole which will admit the point of a pin. This hole receives a ſmall twig reflected from the fifth pair of nerves: the nerve is as ſmall as a ſewing thread; it can be traced along the petrous bone by a ſmall groove, which conducts it to the hole; and when it enters the ear, it goes into the ſame canal with the portio dura, and joins itſelf to it.

4. The hole by which the portio dura paſſes out upon the cheek, is found juſt before the maſtoid, and behind the ſtyloid proceſs; and being betwixt the two, it is named the STYLO-MASTOID hole, and is ſo ſmall, as juſt to admit a pin.

5. The hole for the Euſtachian tube is very irregular. No air can paſs through the membrane of the drum; and as air is neceſſary within the ear, it is conveyed upwards from the palate by the ITER A PALATO AD AUREM, or, as it is commonly called, the EUSTACHIAN TUBE. This tube is long, and of a trumpet form; its mouth, by which it opens behind the noſtril, is wide enough to receive the point of the finger; it grows

gradually ſmaller as it advances towards the ear: it is cartilaginous in almoſt its whole length; very little of it conſiſts of firm bone; ſo that the ſtudent, in examining the ſkull, will hardly find the Euſtachian tube; for the cartilage being rotten away, nothing is left but that end of the canal that is next the ear, and which is open both above and below, ragged, irregular, and broken.

When we have a ſore throat, the pain extends up along this tube into the ear; when we have a cold, both our voice and our hearing is hurt; the one by the ſtuffing of the ſinuſes, the other by the ſtuffing of the Euſtachian tube. When we ſhut the noſe and mouth, and blow ſtrongly, we feel a crackling in the ear, as in the place of the Euſtachian tube; when we dive, we feel the ſame, by the condenſation of the air: and ſometimes by forcing the air ſtrongly upwards through the ear, or by vomits, obſtruction of the Euſtachian tube, and the deafneſs which attends that accident, are very ſuddenly, and we may ſay, violently removed; or ſometimes the cure is attempted by ſyringing, or by cleaning the mouth of this tube with a probe, juſt as we do the external ear.

The other holes do not relate to the ear, and are chiefly for tranſmitting the great blood-veſſels of the brain.

1. The CAROTID ARTERY, the chief artery of the brain, enters into the ſkull near the point of the petrous bone, and juſt before the root of the ſtyloid proceſs. The artery goes firſt directly upwards, then obliquely forwards through the bone, and then again upwards, to emerge upon the inſide of the ſkull; ſo

that the carotid makes the form of an Italic *S*, when it is paſſing through the ſubſtance of the bone; and in place of a mere hole, we find a ſort of ſhort canal, wide, a little crooked, and very ſmooth within. There ſeems to be a particular deſign in this angle, which the artery is forced to make: perhaps it is deſigned to abate the violence with which the blood would drive forwards into the brain; for in many of the lower animals, there are ſtill more particular proviſions than this, the artery being prevented from entering the brain in one great trunk, by a curious diviſion, into many branches, which meet again. It is at this particular point that we are ſenſible in our own body of the beating of theſe two great arteries; and Haller is at pains to inform us, that, during a fever, he felt this beating in a very diſtreſſing degree.

2. The GREAT LATERAL SINUS comes out through the temporal bone, to form the internal jugular vein. The courſe of the ſinus may be eaſily traced by the groove of the occipital bone downwards, behind the pars petroſa: there alſo it makes a deep groove, and ends with a large inteſtine-like turn, which makes a large cavity in the temporal bone, big enough to receive the point of the finger. The ſinus paſſes out, not by any particular hole in the temporal bone, but by what is called a COMMON HOLE, viz. formed one half by the temporal, and one half by the occipital bone. This hole is very large; is lacerated or ragged like. It is ſometimes divided into two openings, by a ſmall point, or ſpine of bone. The larger opening on one ſide of that point tranſmits the great ſinus, where it begins to form the jugular vein; and the ſmaller open-

ing tranſmits the eighth nerve of the ſkull, or par vagum which goes down towards the ſtomach, along with the jugular vein.

There is a ſmall furrow upon the very angle or ridge of the petrous bone, which is made by a ſmall vein of the brain going towards the end of the lateral ſinus.

3. There is a ſmall hole on the outſide of this bone, in the occipital angle; or rather the hole is oftener found in the line of the ſuture (the additamentum ſuturæ ſquamoſæ). Sometimes it is in the occipital bone; or ſometimes it is awanting: it tranſmits a trifling vein from without, into the great ſinus, or a ſmall artery going to the dura mater.

That hollow under the root of the zygomatic proceſs, which lodges the hinge of the jaw-bone, muſt be deſcribed along with the lower jaw.

The ÆTHMOID BONE.—This is perhaps one of the moſt curious bones of the human body. It appears almoſt a cube, not of ſolid bone, but exceedingly light, ſpongy, and conſiſting of many convoluted plates, which form a net-work like honey-comb. It is curiouſly incloſed in the os frontis, betwixt the orbitary proceſſes of that bone. One horizontal plate receives the olfactory nerves, which perforate that plate with ſuch a number of ſmall holes, that it reſembles a ſieve; whence the bone is named cribriform, or æthmoid bone. Other plates dropping perpendicularly from this one, receive the divided nerves, and give them an opportunity of expanding into the organ of ſmelling; and theſe bones, upon which the olfactory nerves are ſpread out, are ſo much convoluted, as to extend the ſurface of

this

this ſenſe very greatly, and are named ſpongy bones. Another flat plate lies in the orbit of the eye; and being very ſmooth by the rolling of the eye, it is named the os planum, or ſmooth bone. So that the æthmoid bone ſupports the forepart of the brain, receives the olfactory nerves, forms the organ of ſmelling, and makes a chief part of the orbit of the eye; and the ſpongy bones, and the os planum, are neither of them diſtinct bones, but parts of this æthmoid bone.

The CRIBRIFORM PLATE is exceedingly delicate and thin; lies horizontally over the root of the noſe; and fills up neatly the ſpace betwixt the two orbitary plates of the frontal bone. The olfactory nerves, like two ſmall flat lobes, lie out upon this plate, and adhering to it, ſhoot down like many roots through this bone, ſo as to perforate it with numerous ſmall holes, as if it had been dotted with the point of a pin, or like a nutmeg grater.

This plate is horizontal; but its proceſſes are perpendicular, one above, and three below.

1. The firſt perpendicular proceſs is what is called CRISTA GALLI; a ſmall perpendicular projection, ſomewhat like a cock's comb, but exceedingly ſmall, ſtanding directly upwards from the middle of the cribriform plate, and dividing that plate into two; ſo that one olfactory nerve lies upon each ſide of the criſta galli; and the root of the falx or ſeptum betwixt the two hemiſpheres of the brain, begins from this proceſs. The foramen cæcum, or blind hole of the frontal bone, is formed partly by the root of the criſta galli, which is very ſmooth, and ſometimes, it is ſaid, hollow or cellular.

2. Exactly oppoſite to this, and in the ſame direction with it, *i. e.* perpendicular to the æthmoid plate,

ſtands out the NASAL PLATE of the æthmoid bone. It is ſometimes called the azygous, or ſingle proceſs of the æthmoid, and forms the beginning of that ſeptum or partition which divides the two noſtrils. This proceſs is thin, but firm, and compoſed of ſolid bone; it is commonly inclined a little to one ſide, ſo as to make the noſtrils of unequal ſize. The azygous proceſs is united with the vomer, which forms the chief part of the partition; ſo that the ſeptum, or partition of the noſe, conſiſts of this azygous proceſs of the æthmoid bone above, of the vomer below, and of the cartilage in the fore or projecting part of the noſe; but the cartilage rots away, ſo that whatever is ſeen of this ſeptum in the ſkull, muſt be either of the æthmoid bone or the vomer.

3. Upon either ſide of the ſeptum, there hangs down a SPONGY BONE, one hanging in each noſtril. They are each rolled up like a ſcroll of parchment: they are very ſpongy; are covered with a delicate and ſenſible membrane; and when the olfactory nerves depart from the cribriform plate of the æthmoid bone, they attach themſelves to the ſeptum, and to theſe upper ſpongy bones, and expand upon them ſo, that the convolutions of theſe bones are of material uſe in expanding the organ of ſmelling, and detaining the odorous effluviæ till the impreſſion be perfect. Their convolutions are more numerous in the lower animals, in proportion as they need a more acute ſenſe. They are named ſpongy, or turbinated bones, from their convolutions, reſembling the many folds of a turban.

The ſpongy bones have a great many honey comb-like cells connected with them, which belong alſo to the organ of ſmell, and which are uſeful perhaps by detaining the effluviæ of odorous bodies, and alſo by reverberating the voice. Thus, in a common cold, while the voice is hurt by an affection of theſe cells, the ſenſe of ſmelling is almoſt loſt.

4. The ORBITARY PLATE of the æthmoid bone is a large ſurface; conſiſting of a very firm plate of bone, of a regular ſquare form; exceedingly ſmooth and poliſhed: it forms a great part of the ſocket for the eye, lying on its inner ſide. When we ſee it in the detached bone, we know it to be juſt the flat ſide of the æthmoid bone; but while it is incaſed in the ſocket of the eye, we ſhould believe it to be a ſmall ſquare bone; and from this, and from its ſmoothneſs, it has got the diſtinct name of OS PLANUM.

5. The OS UNGUIS ſhould alſo, perhaps, be counted as a part of this bone; for though the os unguis, when obſerved in the orbit, ſeems to be a ſmall detached bone, thin like a ſcale, and of the ſize of the finger nail (whence it has its name), yet in the adult, the os unguis is firmly attached to the æthmoid bone; comes along with it when we ſeparate the pieces of the ſkull; and when the os unguis is pared off from the æthmoid bone, the cells are expoſed.

This os unguis, then, is a ſmall ſcaly-like plate, in the inner corner of the orbit juſt over the noſe. We find in it that groove which holds the lachrymal ſac, and conducts it to the noſe; and it is this thin bone that we perforate in making the new paſſage into the noſe, when there is an obſtruction in the natural duct.

6. The CELLS of the æthmoid bone, which form ſo important a ſhare of the organ of ſmell, are arranged in great numbers, along the ſpongy bone. They are

ſmall neat cells, much like a honeycomb; and regularly arranged in two rows, parted from each other by a thin partition; ſo that the os planum ſeems to have one ſet of cells attached to it, while another regular ſet of cells belongs in like manner to the ſpongy bones. The cells are thus twelve in number *, opening into each other, and into the noſe.

Theſe cells are frequently the ſeat of venereal ulcers, and the ſpongy bones are the ſurface where polypi often ſprout up. And from the general connections and forms of the bone, we can eaſily underſtand how the venereal ulcer, when deep in the noſe, having got to theſe cells, cannot be cured, but undermines all the face; how the venereal diſeaſe, having affected the noſe, ſoon ſpreads to the eye, and how even the brain itſelf is not ſafe. We ſee the danger of a blow upon the noſe, which, by a force upon the ſeptum, or middle partition, may depreſs the delicate cribriform plate, ſo as to oppreſs the brain with all the effects of a fractured ſkull, and without any operation which can give relief. And we alſo ſee much danger in pulling away polypi, which are firmly attached to the upper ſpongy bone.

SPHENOIDAL BONE.—The ſphenoidal bone completes the cranium, and cloſes it below. It is named SPHENOID, CUNEIFORM, or WEDGE-LIKE bone, from its being incaſed in the very baſis of the ſkull; or it is named OS MULTIFORME, from its irregular ſhape. It is much of the ſhape of a bat, whence it is often named the PTERYGOID BONE, its temporal proceſſes being like extended wings; its pterygoid proceſſes like feet; its middle

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* The number is commonly twelve, but not regularly ſo.

middle like the body and head of a bat. Its wing-like proceſſes are in the hollow of the temple, forming a part of the ſquamous ſuture, and alſo compoſing a part of the orbit of the eye: Its pterygoid proceſſes hang over the roof of the mouth, forming the back of the noſtrils. The body is in the very centre of the ſkull, and tranſmits almoſt all the nerves of the brain; but ſtill the body bears ſo ſmall a proportion to the bone, that we have not a regular centre to which all the proceſſes can be referred; ſo that we are always, in deſcribing this bone, moving forwards from point to point, from one proceſs or hole to the next.

PROCESSES.—1. The ALÆ, or WINGS, often named temporal proceſſes, riſe up in the temple, to form part of the hollow of the temple; and theſe wings of the ſphenoid bone meeting the frontal, parietal, and temporal bones, by a thin ſcaly edge, they make part of the ſquamous ſuture, and give a ſmooth ſurface for the temporal muſcle to play upon.

2. The other ſide of this ſame proceſs looks towards the ſocket of the eye, and has a very regular and ſmooth ſurface; it is exactly oppoſite to the os planum. As the æthmoid bone forms part of the inſide of the orbit, the wing of the ſphenoid bone forms part of the outſide of the orbit; and ſo the ſurface turned towards the eye is named the ORBITARY PROCESS of the ſphænoid bone.

3. The lower, or back part of this bone runs out into a narrow point, which ſinks in under the petrous portion of the temporal bone, and being ſharp pointed, it is named the SPINOUS PROCESS. It is very remarkable

for a ſmall hole which permits the great artery of the dura mater to enter.

4. The point of this ſpinous proceſs projects in the form of a very ſmall peak, which will hardly be found by the ſtudent. It projects from the baſis of the ſkull juſt within the condyle of the lower jaw; and being a ſmall point, like the point of the ſtilus, or iron pen, it alſo is named STYLOID PROCESS, and gives riſe to a curious muſcle of the palate.

5. The PTERYGOID PROCESS * are four in number, two on either ſide. They are thoſe proceſſes, upon which (with the ſpinous proceſs) the bone naturally ſtands, and which, when we compare it with a bat, repreſent the legs; one of each ſide is named external pterygoid; the other is named the internal pterygoid proceſs.

1. Each EXTERNAL PTERYGOID PROCESS, is thin, flat, and broad, and extends further backwards. Each INTERNAL PTERYGOID proceſs is taller and more ſlender; not ſo flat nor broad. It has its end riſing higher than the other, and tipped with a ſmall neat hook, named the hook of the pterygoid proceſs. The inner pterygoid proceſſes form the back of the noſtrils. The Euſtachian tube comes downwards in a wide groove betwixt the two proceſſes, and then turning its wide mouth towards the noſtril, it opens juſt behind the internal proceſs, viz. behind the noſtril, and over the back of the palate. The hook of the pterygoid proceſs is called the hook of the palate, of which it forms the backmoſt point. The muſculus circumflexus vel tenſor palati, riſing from the mouth of the Euſtachian tube, turns with

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* There is ſome confuſion in this name, ſince pterygoid ſignifies aliform, or wing-like proceſſes.

a ſmall tendon round this hook, like a rope over its pulley; and the great muſcles of the lower jaw, the only ones for moving it ſidewiſe, or for its grinding motions, ariſe from the pterygoid proceſſes, ſo as to be named the external and internal pterygoid muſcles, according to the proceſſes from which they ariſe.

6. The AZYGOUS PROCESS*, is ſo named, from its being ſingle, becauſe it is ſeated in the centre of the bone, ſo that it can have no fellow. It ſtands perpendicularly downwards and forwards, over the centre of the noſe, and its chief uſe is to give a firm ſeat or inſertion for the vomer, or bone, which forms the ſeptum. This with the azygous proceſs of the æthmoid bone united, forms the upper and back parts of the ſeptum; and the vomer, or proper bone of the partition, ſtands, with a ſplit edge, aſtride over theſe two proceſſes, ſo as to have a very firm ſeat.

7. The CLYNOID PROCESSES, have, like many parts of the human body, a very whimſical name, very ill ſuited to expreſs their form; for it is not eaſy, in this inſtance, to acknowledge the likeneſs of four little knobs to bed-poſts; yet the clynoid proceſſes are very remarkable. The two ANTERIOR CLYNOID PROCESSES are ſmall bumps, rather ſharp, projecting backwards, and terminating in two flat projecting points. The POSTE-

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* Azygous is a term, which is applied to ſuch parts as have no fellow; becauſe almoſt always the parts on one ſide of the body are balanced by ſimilar and correſponding parts on the other ſide. When they ſtand in the centre of the body, or are otherwiſe ſingle, we call them azygous; and ſo the azygous proceſs of the æthmoid and ſphenoid, and other bones; or the azygous vein, which runs in the centre of the thorax, and is ſingle.

RIOR CLYNOID PROCESSES, riſe about an inch further backwards, and are, as it were, oppoſed to the others. They riſe in one broad and flat proceſs, which divides above into two points, ſmall and round, or knobby at their points; and they look forwards towards the anterior clynoid proceſſes.

The SELLA TURCICA EPHIPPIUM, or Turkiſh ſaddle, is the ſpace incloſed by theſe four proceſſes, and is well named. The ſella turcica ſupports the pituitary gland, an appendage of the brain, the uſe of which is unknown. The carotid arteries riſe up by the ſides of the ſella turcica, and mark its ſides with a broad groove. The optic nerves lie upon a groove at the fore part of the ſella turcica, betwixt the two anterior clynoid proceſſes; and ſometimes the two anterior proceſſes ſtretch backwards, till they meet the poſterior ones, and form an arch, under which the carotid artery paſſes. Often the poſterior clynoid knobs cannot be fairly diſtinguiſhed; ſince, in many ſkulls, they form but one broad proceſs.

This bone has alſo its cells, for all that part which we call the body of the bone, all the ſella turcica, that ſpace which is betwixt the clynoid proceſſes within and the azygous proceſs without, is hollowed into one large cell, divided with a middle partition. It is indeed leſs regular than the other cells; it is ſometimes very large, ſometimes it is not to be found; it has other trifling varieties, which it were idle to deſcribe. As it communicates with the æthmoid cells, it probably performs one office with them; is almoſt a continuation of them, ſo that when any one is leſs or awanting, the others are proportionally larger.

HOLES.—The ſphenoid bone is ſo placed in the very centre of the ſkull, that its holes tranſmit the principal nerves of the ſkull, and it bears the marks of the chief arteries.

1. The OPTIC HOLES, are large, round holes, juſt under each anterior clynoid proceſs. We trace the optic nerves, by a large groove into each optic hole; and an artery goes along with them, named the ophthalmic artery, about the ſize of a crow-quill, twiſting round the optic nerve, and giving arteries to the eyelids, muſcles, and lachrymal gland, but moſt eſpecially to the ball and humours of the eye itſelf. This ocular or ophthalmic artery comes off from the great carotid, while it lies by the ſide of the ſella turcica; and it is a branch again of this ocular artery, which goes out upon the forehead, forming the ſuperciliary notch, or hole.

2. The FORAMEN LACERUM, is next in order, and is ſo named, becauſe it is a wide ſlit. The foramen lacerum is wide near the ſella turcica, grows gradually narrower, as it goes out towards the temple, till it terminates almoſt in a ſlit. The upper line of the foramen lacerum is formed by the anterior clynoid proceſs, extending outwards, ſharp and flat: And this is what ſome have choſen to diſtinguiſh by the name of TRANSVERSE SPINOUS PROCESS, or the little wing of Ingraſias, who had obſerved it.

The nerves of the ſkull are counted from before backwards. There are nine nerves proper to the ſkull; the 1ſt, or olfactory nerve, perforates the cribriform bone; the 2d, or optic nerve, paſſes through the optic hole; the 3d, the 4th, part of the 5th, and the whole of the 6th pairs of the nerves, paſs through this foramen lacerum, or wide hole, to go alſo into the eye. The optic nerve forms the proper organ of viſion. The ſmaller nerves of the 3d, 4th, 5th, and 6th pairs, go to animate its muſcles, with the trifling exception of ſome ſmall twigs, which, paſſing through the orbit, mount upon the forehead, or go downwards into the noſe.

3. The FORAMEN ROTUNDUM, is named from its round ſhape. The foramen opticum is indeed round, but it has already got an appropriated name. Now to give the young anatomiſt a regular notion of this, and of the next hole, we muſt enumerate the branches of the 5th pair. The fifth nerve of the brain is as broad as the little finger, and lies by the ſide of the ſella turcica, where it divides into three leſſer nerves, which are called branches of the 5th pair. The firſt branch of the 5th pair is deſtined for the eye; the ſecond branch of the 5th pair for the upper jaw; the third branch of this 5th pair for the lower jaw: ſo the firſt branch of the 5th pair paſſes through the foramen lacerum to the eye; the ſecond branch of the 5th pair paſſes through the foramen rotundum to the upper jaw; the third branch of this great nerve paſſes through the foramen ovale to the lower jaw; and if we had any faith in the doctrines of nervous ſympathy, we ſhould ſay, here is a wide ſympathy provided among the nerves of the eye, the face, and the lower jaw.

The foramen rotundum, then, is a hole exactly round, pretty large, opening immediately under the inner end of the foramen lacerum, and tranſmitting the

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ſecond branch of the 5th pair of nerves to the upper jaw.

4. The FORAMEN OVALE, is an oval hole, larger than the foramen rotundum; about half an inch behind it; and tranſmitting the third branch of the 5th pair to the lower jaw.

5. The FORAMEN SPINALE, or SPINOUS HOLE, is a very ſmall round hole, as if made with a large pin; is in the very point of the ſpinous proceſs; is one third of an inch behind the oval hole, and tranſmits the ſmall artery, leſs than a crow-quill, which conſtitutes the chief artery of the dura mater, viz. that artery which makes its impreſſion upon the parietal bone.

6. There is ſtill another hole, which tranſmits a nerve, curious in this reſpect, that it is not going out from the ſkull, but returning into it; for the ſecond branch of the 5th pair, or the ſuperior maxillary nerve, ſends a ſmall branch backwards, which having come within the ſkull, enters the temporal bone, and goes to join itſelf to the portio dura of the 7th pair, and in its way gives a ſmall branch, to help out the ſlender beginning of the great ſympathetic nerve. This retrograde branch of the maxillary nerve gets back again into the ſkull, by a hole which is found, juſt under the root of each pterygoid proceſs, whence it is named PTERYGOID HOLE*; or by many, is named after its diſcoverer, the VIDIAN HOLE †. This hole is almoſt hidden

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* This retrograde twig, is the little nerve which perforates the os petroſum on its fore part. *Vide* page 70.

† Vidus Vidius, a profeſſor of Paris, and phyſician to Francis the firſt,

under the point of the petrous bone, is not to be ſeen, but in the ſeparated bones, and is nearly of the ſize of the ſpinous hole.

If there are found ſome minute holes about the ſella turcica, they are only the marks of ſome blood-veſſels, entering the bone to nouriſh it.

CHAP. IV.

OF THE BONES OF THE FACE AND JAWS.

THE face is compoſed of a great number of ſmall bones, which are grouped together, under the common name of upper jaw. There are ſix bones on either ſide of the face; but as their names could convey no diſtinct notion of the uſes, forms, or places of theſe bones, to enumerate them were but waſte of time: they have indeed ſutures, and their ſutures have been very regularly enumerated; but theſe bones meet each other by ſuch thin edges, that no indentation nor proper ſuture is formed. None of theſe ſutures run for any length, or are of any note; therefore I have only this to ſay concerning the ſutures of the face, that they are acknowledged to be purely a conſequence of the oſſification having begun in many points: no particular deſign of nature has been ſuppoſed. The ſutures, if they require names, are to be named after the bones which they unite.

OSSA NASI.—The oſſa naſi are ſmall bones, rather thin, having no cancelli, being merely firm and condenſed plates. They are convex outwardly, ſo that the two together form nearly an arch. They are oppoſed to each other by a pretty broad ſurface, ſo that their thin arch is firm. They have a flat rough ſurface, by which they are laid upon the rough ſurface of the frontal bone; ſo that there alſo their connection is ſtrong. They are incloſed by a branch of the upper jaw-bone, which ſtretching upwards, is named its naſal proceſs: and they lie with their edges under it in one part, and above it in another, in ſuch a way, that they cannot eaſily be forced in. Laſtly, their lower edge is rough, for the firm attachment of the cartilages of the noſe; and their loweſt point, or that where the bones of the noſe and the griſtles of the noſe are joined, is the moſt prominent point (or as it is vulgarly called the bridge) of the noſe; from which connection, notwithſtanding its firmneſs, the cartilages are ſometimes luxated.

Os UNGUIS, ſo named from its being of the ſize and ſhape of a nail; or ſometimes named the OS LACHRYMALE, from its holding the duct which conveys the tears, is that thin ſcale of bone which I have deſcribed as belonging to the os æthmoides. It is commonly deſcribed as a diſtinct bone; it is a thin flat bone, a ſingle ſcale, without any cancelli; it is found in the inner angle of the eye, at its forepart, and juſt touching the top of the noſe; it has a large groove in it for holding the lachrymal ſac and duct. One half of this bone is behind the groove, and there the eye rolls upon it. One half of it is occupied by the groove for the naſal duct; and the other ſide of the groove is formed by the riſing branch, or naſal proceſs, as it is called, of the upper jaw-bone. The os unguis is delicate, and eaſily broken, being as thin as a ſheet of paper. It is this bone which is pierced in the operation for the fiſtula lachrymalis; which is eaſily done, almoſt with a blunt ſteel or probe; and the chief caution is to keep forwards, ſo as to perforate in the place of the groove, as that will lead into the noſe, and not behind it, which would carry the perforating inſtrument into the æthmoidal ſinuſes, and perhaps wound the ſpongy bone.

This bone ſeems peculiarly liable to caries, which is perhaps the nature of all theſe thin bones; for as they have no marrow, they muſt depend entirely on their perioſteum, which they are no ſooner robbed of than they die.

OSSA MAXILLARIA SUPERIORA.—The upper jaw-bones are particularly worthy of notice; for here we find all that is curious in the face, even to its ſize and ſhape. The upper jaw-bones are of very great ſize, forming as it were the foundation or baſis of the face. They ſend a large branch upwards, which forms the ſides of the noſe; a broad plate goes backwards, which forms the roof of the palate; there is a circular projection below, which forms the alveoli, or ſockets of the teeth. The upper jaw-bones are quite hollow within, forming a very large cavity, which is capable of containing an ounce of fluid or more. The ſize of this cavity ſeems to determine the height of the cheek-bone, and the form of the face; and the diſeaſed enlargement of this cavity raiſes the cheek-bone, leſſens the eye, and deforms the face in a very extraordinary degree.

Theſe proceſſes, and this cavity of the bone, are what deſerve moſt particular notice.

1. The firſt is the NASAL PROCESS, which extends upwards, to form the ſide of the noſe. It is arched outwards, to give the noſtrils ſhape. Its ſides ſupport the naſal bones; and the cartilages of the alæ naſi, or wings of the noſe, are fixed to the edges of this proceſs.

2. A plate of this bone is called the orbitary proceſs. This thin plate is the roof of the great cavity, which occupies this bone entirely. It is at once as a roof to the antrum maxillare, and as a floor for the eye to roll upon. There is a wide groove along the upper ſurface of this plate, in which the chief branch of the upper maxillary nerve lies: And this branch, named infra orbitary nerve from its lying thus under the eye, comes out by a hole of the jaw-bone under the eye, which is named infra orbitary hole. And thus the nerve appearing upon the cheek, is the chief nerve of the face.

3. This great bone is the baſis upon which the cheek-bone ſtands; and that it may have a firm place, there is a rough and (as anatomiſts call it) ſcabrous ſurface, which makes a very firm ſuture with the cheek-bone; and as this ſurface riſes a little, it is named the malar proceſs.

4. From the lower circle of this bone, there projects a ſemicircle of bone, which is for lodging the teeth of the upper jaw. This circle of bone is as deep as the fangs of the teeth are long. And it may be very truly named a proceſs (PROCESSUS ALVEOLARIS), ſince it does not exiſt in the fœtus, nor till the teeth begin to be formed; ſince it grows along with the teeth, and is abſorbed and carried clean away when in old age the teeth fall out. The ſides of the ſockets in which the teeth are lodged are extremely thin, and ſurround them cloſely. The teeth are ſo cloſely embraced by their ſockets, and we are ſo far from being poſſeſſed of any inſtrument by which they can be pulled perpendicularly out, that the ſockets can ſeldom eſcape; they are broken or ſplintered in perhaps one of four extractions, even by the moſt dexterous artiſts in that line.

5. The PALATE PROCESS is a plate of bone which divides the noſe from the mouth, conſtituting the roof of the palate, and the floor or bottom of the noſtrils. This plate is thinner in its middle, and thicker at either edge: thus, it is thick where it firſt comes off from the alveolar proceſs; it is thin in its middle; and it is again thick where it meets its fellow of the oppoſite ſide. For at the place where the two upper jawbones meet, the palate plate is turned upwards, ſo that the two bones are oppoſed to each other in the middle of the palate, by a broad flat ſurface, which cannot be ſeen but by ſeparating the bones. This ſurface is ſo very rough, that the middle palate ſuture almoſt reſembles the ſutures of the ſkull; and the maxillary bones are neither eaſily ſeparated, nor eaſily

joined again. This meeting of the palate plates by a broad ſurface, makes a riſing ſpine, or ſharp ridge towards the noſtrils; ſo that the broadneſs of the ſurface by which theſe bones meet, ſerves a double purpoſe; it joins the bones ſecurely, and it forms a ſmall ridge upon which the ſplit edge of the vomer, or partition of the noſe, is planted. Thus we find the palate plate of the maxillary bones conjoined; forming almoſt the whole of the palate, while what are properly called the palate bones form a very ſmall ſhare of the back part only. As theſe thinner bones of the face have no marrow, they are nouriſhed by their perioſteum only; they are of courſe perforated with many ſmall holes. A great many minute holes are found along the palate plate, about the place of the ſockets, and indeed all over the maxillary bones: And this is particular in the palate, that the hard membrane, or covering of it, is fixed to the bony plate by many rough tubercles, and even by ſmall hooks, which are eaſily ſeen in the dried bone.

6. The ANTRUM MAXILLARE, or cavity of the jawbone, is commonly named ANTRUM HIGHMORIANUM, after its diſcoverer Highmore. We have gone round the antrum, on all its ſides, in deſcribing theſe proceſſes of the bone: The palate plate makes the floor of the antrum; the orbitary proceſs makes its roof; the cheek, quite up from the ſockets of the teeth to the lower part of the eye, forms its walls or ſides; ſo that when the antrum enlarges, it is the cheek that becomes deformed; and when we deſign to open the antrum, we either perforate the cheek, or pull one of the teeth. The antrum is concave towards the cheek, but

it has a flat ſide towards the noſe; it is divided from the cavity of the noſtril by a flat and very thin plate of bone; it ſeems in the naked ſkull to have a very wide opening, and the lower ſpongy bone is hung by a ſmall hook upon the edge of this thin ſeptum, which divides the antrum from the noſe; but in the ſkull, covered with its ſoft parts, we find the antrum almoſt cloſed by a membrane which ſtretches over the opening, and leaves but one or two very ſmall holes of the ſize of the ſmalleſt pea, by which, perhaps, the reverberation of ſound in the antrum is more effectual in raiſing the voice, and by which ſmall hole, the mucus, which is ſecreted in the antrum, drops out into the noſe. The cavity of the antrum, like the inner ſurfaces of the noſtrils, is covered with a membrane, and is bedewed with mucus; and the mucus drops more or leſs freely in various poſitions of the head. Sometimes by cold, or other accidents, inflammations and ſwellings of the membrane come on; the holes are cloſed; the drain of matter is ſuppreſſed and confined within, and the cheek ſwells. Perhaps there may be ſome particular diſeaſe of the membrane with which the cavity is lined, or of the bone itſelf: in one way or other, diſeaſes of this cavity, and collections of matter, dreadful pain and caries of the bone are very frequent; then the cheek riſes; the face is irrecoverably deformed; ſometimes the matter makes its way by the ſides of the teeth, or at laſt, it burſts through the bones, makes an ulcer in the cheek; and then there is a natural cure, but ſlow and uncertain. There is no very ſure mark of this diſeaſe; it may be known by an attentive retroſpect of all the circumſtances. The diſeaſe is not to be eaſily nor certainly diſcovered; but a very long continued toothach, an uncommon degree of pain, or greater affection of the eye, with a ſwelling and redneſs, and gradual riſing of the cheek, are very ſuſpicious ſigns. The pulling of the ſecond or third of the grinding teeth, often brings a ſplinter away with it, which opens a road for the matter to flow; or though there be no breach of the ſocket, often the confined matter follows the teeth, becauſe not unfrequently the longer fangs of the grinders naturally penetrate quite into this cavity of the jaw: if the matter ſhould not flow, the floor of the antrum is eaſily perforated, by introducing a ſharp ſtillet by the ſocket of the tooth that is pulled. The flow of the matter gives relief, and injections of various medicines complete the cure. But as this opening is ſometimes a cure, it is ſometimes alſo a diſeaſe; for the breaking of a ſocket, ſometimes opening a way into this antrum, there follows inflammation of its internal ſurface, a running of matter, and ſometimes caries of the bone.

HOLES.—The holes of the jaw-bone are two only: 1. The INFRA-ORBITARY hole, for tranſmitting the infra-orbitary nerve from the bottom of the eye, comes along under the eye in a bony groove, and makes generally one large round hole on the cheek, juſt under the margin of the orbit, or ſometimes the nerve divides and makes two ſmaller holes in its paſſage upon the cheek; and, 2. A hole in the palate plate, which belongs equally to each of the palate bones; for it is betwixt the two bones in the fore part, or beginning of the palate ſuture behind the two firſt cutting teeth. This hole is named FORAMEN INCISIVUM, as opening juſt behind the inciſive or cutting teeth; or it is named ANTERIOR PALATINE HOLE, to diſtinguiſh it from one in the back of the palate: This hole is large enough to receive the point of a quill; it is ſingle towards the mouth; but towards the noſe, it has two large openings, one opening diſtinctly into each noſtril.

3. But it will be well to explain here a third hole, which is common to the maxillary with the proper palate bones. It is formed on the back part of the palate (one on either ſide), in the ſuture which joins the palate-bones to the jaw-bones: It is named POSTERIOR PALATINE HOLE: It is as large as the interior palatine hole, but it ſerves a much more important purpoſe; for the upper maxillary nerve ſends a large branch to the palate, which branch comes down behind the back of the noſtril, perforates the back of the palate, by the poſterior palatine hole, and then goes forward in two great branches along the palate. Thus the chief, or, we might ſay, the only nerves of the palate come down to it through theſe poſterior palatine holes: but the uſe of the anterior palatine hole is a problem ſtill; for we cannot believe that ſo great a hole, ſo very regular, and ſo curiouſly divided, ſo as to open into the two noſtrils, can be quite uſeleſs; yet the meaning of this hole has never been explained. It looks almoſt as if it were merely deſigned for giving the ſoft palate a ſurer hold upon the bone; for no ducts have been found opening into the palate from the noſe; nor any glands with their ducts ſeated here; nor any nerves paſſing either from the noſe to

the palate, or from the palate to the noſe; nor any artery, except one of the moſt trifling ſize. In ſhort, anatomiſts having ſought with care for any thing that might explain its uſe, have ſtill found nothing but the hard membrane filling up the anterior hole.

The whole ſurface of the bone which forms the antrum, is perforated with frequent ſmall holes, eſpecially towards its back part, tranſmitting ſmall arteries and nerves to the teeth; and the back of the antrum forms with the orbitary part of the ſphenoid bone a ſecond foramen lacerum for the eye; an irregular opening towards the bottom of the ſocket, which is for the accumulation of fat, not for the tranſmiſſion of nerves; and it is from the waſting of this fat, taken back into the ſyſtem, that the eye ſinks ſo remarkably in fevers, conſumptions, and ſuch other diſeaſes as waſte the body.

The OSSA PALATI, or PALATE BONES—are very ſmall, but have ſuch a number of parts, and ſuch curious connections as are not eaſily explained. They ſeem to eke out the ſuperior maxillary bones, ſo as to lengthen the palate, and complete the noſtrils behind: they even extend upwards into the ſocket, ſo as to form a part of its circle; although, in looking for them upon the entire ſkull, all theſe parts are ſo hidden, that we ſhould ſuppoſe the palate bones to be of no greater uſe nor extent than to lengthen the palate a little backwards.

The parts of the palate bone are theſe:

1. The PALATAL PLATE, or proceſs of the palate bone, whence it has its name, lies horizontal in the

ſame level with the palatal proceſs of the jaw-bone, which it reſembles in its rough and ſpinous ſurface; in its thinneſs; in its being thinner in the middle, and thicker at either end; in its being oppoſed to its fellow by a broad ſurface, which completes the MIDDLE PALATE SUTURE; and it is connected with the palate proceſs of the jaw, by a ſuture reſembling that by which the oppoſite bones are joined; but this ſuture going acroſs the back part of the palate, is named the TRANSVERSE PALATE SUTURE. Where the two palate bones are joined, they run backwards into an acute point; on either ſide of that middle point, they make a ſemicircular line, and again run out into two points behind the grinding teeth of each ſide. By this figure of the bones, the back line of the palate has a ſcolloped or waved form. The velum palati, or curtain of the palate, is a little arched, following the general line of the bones; the uvula or pap hangs exactly from the middle of the velum, taking its origin from the middle projecting point of the two bones; and a ſmall muſcle, the azygus uvulæ, runs down in the middle of the velum, taking its origin from this middle point.

2. The ſmall projecting point of the palate bone, juſt behind the laſt grinding tooth, touches the pterygoid proceſs of the ſphenoid bone; it is therefore named the PTERYGOID PROCESS of the palate bone; but it is ſo joined with the pterygoid proceſs of the ſphenoidal bone, that they are not to be diſtinguiſhed in the entire ſkull. The poſterior pterygoid hole, or third hole of the palate, is juſt before this point.

3. The NASAL PLATE OR PROCESS, is a thin and ſingle plate; riſes perpendiculary upwards from the palate; lies upon the ſide and back part of the noſtrils, ſo as to form their opening backwards into the throat; it is ſo joined to the upper jaw-bone, that it lies there like a ſounding-board upon the ſide of the antrum Highmorianum, and completes that cavity forming the thin partition betwixt it and the noſe.

4. This naſal proceſs extends thus up from the back arch of the palate to the back part of the orbit; and though the naſal plate is very thin and delicate in its whole length, yet, where it enters into the orbit, it is enlarged into an irregular kind of knob of a triangular form. This knob is named its ORBITARY PROCESS; or, as the knob has two faces looking two ways in the orbit, it is divided ſometimes (as by Monro the father) into two orbitary proceſſes, the anterior and poſterior; the anterior one is the chief. This orbitary proceſs, or point of the palate bone, being triangular, very ſmall, and very deep in the ſocket, is not eaſily diſcovered in the entire ſkull.

5. This orbitary proceſs is moſt commonly hollow or cellular, and its cells are ſo joined to thoſe of the ſphenoid bone, that it is the palate bone that ſhuts the ſphenoid cells, and the ſphenoid and PALATINE CELLS of each ſide conſtitute but one general cavity.

The OSSA SPONGIOSA, or TURBINATA, INFERIORA, are ſo named, to diſtinguiſh them from the upper ſpongy bones, which belong to the os æthmoides; but theſe lower ſpongy bones are quite diſtinct,

tinct, formed a-part, and connected in a very ſlight way with the upper jaw-bones.

The OSSA SPONGIOSA INFERIORA, are two bones, much rolled or convoluted; very ſpongy; much reſembling puff-paſte, having exactly ſuch holes, cavities, and net-work, as we ſee in raiſed paſte, ſo that they are exceedingly light. They lie rolled up in the lower part of the noſe; are particularly large in ſheep; are eaſily ſeen either in the entire ſubject, or in the naked ſkull. Their point forms that projection, which is touched with the finger in picking the noſe; and from that indecent practice, very often ſerious conſequences ariſe, for in many inſtances, polypi of the lower ſpongy bones, which can be fairly traced to hurts of this kind, grow ſo, as to extend down the throat, cauſing ſuffocation and death.

One membrane conſtitutes the univerſal lining of the cavities of the noſe, and the coverings of all the ſpongy bones. This continuity of the membrane, prevents our ſeeing in the ſubject, how ſlightly the ſpongy bones are hung; but in the bare and diſſected ſkull, we find a neat ſmall HOOK upon the ſpongy bone, by which it is hung upon the edge of the antrum maxillare; for this lower ſpongy bone is laid upon the ſide of the antrum, ſo as to help the palate bone, in cloſing or covering that cavity from within. One END of the ſpongy bone, rather more acute, is turned towards the opening of the noſtril, and covers the end of the lachrymal duct: the other END of the ſame bone, points backwards towards the throat. The curling plate, hangs down into the cavity of the noſtril,

tril, with its arched ſide towards the noſe. This ſpongy bone differs from the ſpongy proceſs of the æthmoid bone, in being leſs turbinated or complex; in having no cells connected with it; and perhaps it is leſs directly related to the organ of ſmell. If polypi ariſe from the upper ſpongy bone, we can uſe leſs freedom, and dare hardly pull them away, for fear of injuring the cribriform plate of the æthmoid bone: we are indeed not abſolutely prohibited from pulling the polypi from the upper ſpongy bone; but we are more at eaſe, in pulling them from the lower one, ſince it is quite an inſulated bone. When peaſe, or any ſuch foreign bodies, are detained in the noſe, it muſt be from their ſwelling, and being detained, among the ſpongy bones.

The ſpongy bones are not abſolutely limited in their number: there is ſometimes found betwixt theſe two, a third ſet of ſmall turbinated bones, commonly belonging to the æthmoid bone.

VOMER.—The noſe is completed by the vomer, which is named from its reſemblance to a ploughſhare, and which divides the two noſtrils from each other. It is a thin and ſlender bone, conſiſting evidently of two plates much compreſſed together; very denſe and ſtrong, but ſtill ſo thin, as to be tranſparent. The two plates of which the vomer is compoſed, ſplit or part from each other at every edge of it, ſo as to form a groove on every ſide. 1. On its upper part, or as we may call it, its baſe, by which it ſtands upon the ſkull, the vomer has a WIDE GROOVE, receiving the projecting point of the æthmoid and ſphænoid bones: thus it ſtands very firm and ſecure, and capable of reſiſting very violent blows. 2. Upon its lower part, its groove is narrower, and receives the riſing line in the middle of the palate plate, where the bones meet, to form the palate ſuture. At its fore-part, it is united by a ragged ſurface, and by ſomething like a groove, to the middle cartilage of the noſe; and as the vomer receives the other bones into its grooves, it is, in a manner, locked in on all ſides: it receives ſupport and ſtrength from each; and if the vomer and its cartilage ſhould ſeem too ſlender a ſupport for the fabric of the noſe, let it be remembered, that they are all firmly connected, and covered by one continuous membrane, which is thick and ſtrong, and that this is as a perioſteum, or rather like a continued ligament, which increaſes greatly the thickneſs and the ſtrength of every one of theſe thin plates. The vomer, in almoſt every ſubject, bends much towards one or other noſtril, ſo as ſometimes to occaſion no ſmall apprehenſion, when it happens to be firſt obſerved.

OS MALÆ, or the bone of the cheek, is eaſily known, and is a very unimportant one. It is that large ſquare bone which forms the cheek: it has four diſtinct points, which anatomiſts have choſen to demonſtrate, with a very ſuperfluous accuracy. 1. The UPPER ORBITARY proceſs ſtands higheſt, running upwards to form part of the ſocket, the outer corner of the eye, and the ſharp edge of the temple. 2. The INFERIOR ORBITARY PROCESS, which is juſt oppoſite to this, forming the lower part of the orbit, and the edge of the cheek. 3. The MAXILLARY PROCESS, is that broad and rough ſurface, by which it is joined to the upper jaw-bone. 4. There is another proceſs, the beſt entitled to the name of proceſs, becauſe it ſtands out quite inſulated, and goes outwards and backwards to unite with the temporal bone, in forming the zygoma or temporal arch; it is named the ZYGOMATIC PROCESS. 5. That plate, which goes backwards to form the floor of the orbit, is named the INTERNAL ORBITARY PROCESS. This bone has no holes, except ſuch minute ones as tranſmit arteries, merely for the nouriſhment of the bone itſelf.

OS MAXILLÆ INFERIORIS.—The lower jawbone, is likened to a horſe-ſhoe, or to a creſcent, or to the letter U, though we need be under no anxiety about reſemblances for a form ſo generally known. There is ſuch an infinite complication of parts ſurrounding the jaw, of glands, muſcles, blood-veſſels, and nerves, that it were endleſs to give even the ſlighteſt account of theſe. They ſhall be reſerved each for its proper place, while I explain the form of the lower jaw, in the moſt ſimple and eaſy way.

1. The fore part, or chin, is, in a handſome and manly face, very ſquare; and this portion is marked out by this ſquareneſs, and by two ſmall holes, one on either ſide, by which the nerves of the lower jaw come out upon the face.

2. The baſe of the jaw, is a ſtraight and even line, terminating the outline of the face. It is diſtinctly traced all along, from the firſt point of the chin, backwards to the angle of the jaw. Fractures of this bone are always more or leſs tranſverſe, and are eaſily known by the falling down of one part of this even line, and by feeling the craſhing bones when the fal-

len part is raiſed. Such fractures happen from blows or falls; but not by pulling teeth, for the ſockets of the teeth bear but a ſmall proportion to the reſt of the jaw; even in children this cannot happen, for in them the teeth have no roots, and have no hold nor dangerous power over the jaw. Though (as I have ſaid) the ſockets often ſuffer, the jaw itſelf never yields.

3. The angle of the jaw, is that corner where the baſe of the jaw ends, where the bone riſes upwards, at right angles, to be articulated with the head. This part alſo is eaſily felt, and by it we judge well of the ſituation of veins, arteries, and glands, which might be in danger of being cut, in wounds or in operations. There are two proceſſes of the jaw, of particular importance, the coronoid or horn-like proceſs, for the inſertion of its ſtrong muſcles, eſpecially of the temporal muſcle, and the condyloid or hinge proceſs, by which it is jointed with the temporal bone.

4. The CORONOID PROCESS, named from its reſemblance to a horn, is, like the reſt of the jaw-bone, flat on its ſides, and turned up with an acute angle, very ſharp at its point, and lying exactly under the zygoma, or temporal arch. The temporal muſcle runs under this arch, and lays hold on the coronoid proceſs; not touching it on one point only, but graſping it on every ſide, and all round. And the proceſs is ſet ſo far before the articulation of the jaw, that it gives the muſcle great power. This proceſs is ſo defended by the temporal arch, and ſo covered by muſcles, that it cannot be felt without.

5. The CONDYLOID PROCESS, or the articulating proceſs of the jaw, is behind this, and is formed by the body of the bone turned up at its angle. This alſo is of the ſame flat form with the reſt of the jaw. The condyle, or joint of the jaw-bone, is placed upon the top of this riſing branch. The condyle, or articulating head, is not round, but flat, of a long form, and ſet acroſs the branch of the jaw. This articulating proceſs is received into a long hollow of the temporal bone, juſt under the root of the zygomatic proceſs; ſo that by the long form of the condyles, and of the cavity into which it is received, this joint is a mere hinge, not admitting of lateral nor rotatory motions, at leaſt of no wider lateral motions than thoſe which are neceſſary in grinding the food; but the hinge of the jaw is a complex and very curious one, which ſhall be explained in its proper place.

6. The ALVEOLAR PROCESS, or the long range of ſockets for the teeth, reſembles that of the upper jaw. The jaw, as the body grows, is ſlowly increaſing in length, and the teeth are added in proportion to the growth of the jaws. When the jaws have acquired their full ſize, the ſockets are completely filled; the lips are extended, and the mouth is truly formed. In the decline of life, the teeth fall out, and the ſockets are reabſorbed, and carried clean away, as if they had never been; ſo that the chin projects, the cheeks become hollow, and the lips fall in, the ſureſt marks of old age.

The ſucceſſive changes of the form of the jaw are worthy of being mentioned once more; firſt, That in the child, the jaw conſiſts of two bones, which are joined ed ſlightly together in the chin. This joining, or ſymphyſis, as it is called, is eaſily hurt, ſo that in preternatular labours it is, according to the common method of pulling by the chin, always in danger, and often broken. During childhood the proceſſes are blunt, and ſhort, do not turn upwards with a bold and acute angle, but go off obliquely from the body of the bone. The teeth are not rooted, but ſticking ſuperficially in the alveolar proceſs; and another ſet lies under them, ready to puſh them from the jaws.

Secondly, That in youth, the alveolar proceſs is extending, the teeth are increaſing in number. The coronoid and articulating proceſſes are growing acute and large, and are ſet off at right angles from the bone. The teeth are now firmly rooted; for the ſecond ſet has come up from the ſubſtance of the jaw.

Thirdly, In manhood, the alveolar proceſs is ſtill more elongated. The dentes ſapientiæ are added to the number of the teeth; but often, by this, the jaw is too full, and this laſt tooth coming up from the backmoſt point of the alveolar proceſs in either jaw, it ſometimes happens, that the jaw cannot eaſily cloſe; the new tooth gives pain; it either corrupts, or it needs to be drawn.

Fourthly, In old age, the jaw once more falls flat; it ſhrinks according to the judgment by the eye, to half its ſize; the ſockets are abſorbed, and conveyed away; and in old age the coronoid proceſs riſes at a more acute angle from the ſkull, and by the falling down of the alveolar proceſs, the coronoid proceſs ſeems increaſed in length.

HOLES.—The holes of the lower jaw-bone are chiefly two:

1. A LARGE HOLE on the inner ſide, and above the angle of the jaw, juſt at the point where theſe two branches, the condyloid and the coronoid proceſſes part. A wide groove from above downwards, leads to the hole; and the hole is, as it were, defended by a ſmall point, or pike of bone, riſing up from its margin. This is the GREAT HOLE for admitting the LOWER MAXILLARY NERVE into the hollow of the jaw, where it goes round within the circle of the jaw, diſtributing its nerves to all the teeth. But at the point where this chief branch of the nerve goes down into the jaw, another branch of the nerve goes forward to the tongue. And as nerves make an impreſſion as deep as that of arteries in a bone, we find here two grooves, firſt, One marking the place of the great nerve, as it advances towards its hole; and, ſecondly, A ſmaller groove, marking the courſe of the leſſer branch, as it leaves the trunk, and paſſes this hole to go forward to the tongue.

Along with this nerve, the lower maxillary artery, a large branch, enters alſo by the hole; and both the nerve and the artery, after having gone round the canal of the jaw, emerge again upon the chin.

2. The ſecond hole of the lower jaw is that on the ſide of the chin, about an inch from the point which permits the remains of the great nerve and artery (almoſt expended upon the teeth) to come out upon the chin; it is named the MENTAL HOLE.

CHAP. V.

OF THE TRUNK;

OR,

THE SPINE, THORAX, AND PELVIS,

THE SPINE.

THE ſpine is ſo named from certain projecting points of each bone, which ſtanding outwards in the back, form a continued ridge; and the appearance of continuity is ſo complete, that the whole ridge is named ſpine, which, in common language, is ſpoken of as a ſingle bone. This long line conſiſts of twenty-four diſtinct bones, named vertebræ, from the Latin vertere, to turn. They conduct the ſpinal marrow, ſecure from harm the whole length of the ſpine; and ſupport the whole weight of the trunk, head and arms; they perform, at certain points, the chief turnings and bendings of the body; and do not ſuffer under the longeſt fatigue, or the greateſt weight which the limbs can bear. Hardly can any thing be more beautiful or ſurpriſing than this mechaniſm of the ſpine, where nature has eſtabliſhed the moſt oppoſite and inconſiſtent functions in one ſet of bones; for theſe bones are ſo free in motion, as to turn continually, yet ſo ſtrong as to ſupport the whole weight of the body; and ſo flexible as to turn quickly in all directions, yet ſo ſteady within, as to contain and defend the moſt material and the moſt delicate part of the nervous ſyſtem.

The vertebræ are arranged according to the neck, back, and loins, and the number of pieces correſponds with the length of theſe diviſions. The vertebræ of the LOINS are five in number, very large and ſtrong, and bearing the whole weight of the body. Their proceſſes ſtands out very wide and free, not entangled with each other; and perform the chief motions of the trunk. The vertebræ of the BACK are twelve in number. They alſo are big and ſtrong, yet ſmaller than thoſe of the loins; their proceſſes are laid over each other; each bone is locked in with the next, and embarraſſed by its connection with the ribs; this is therefore the ſteadieſt part of the ſpine, a very limited motion only is allowed. The vertebræ of the NECK are ſeven in number; they are more ſimple, and like rings; their proceſſes hardly project; they are very looſe and free; and their motions are the wideſt and eaſieſt of all the ſpine.

The ſeven vertebræ of the neck, twelve of the back, and five of the loins, make twenty-four in all, which is the regular proportion of the ſpine. But the number ſometimes varies according to the proportions of the body; for where the loins are long, there are ſix vertebræ of the loins, and but eleven in the back; or the number of the pieces in the back is ſometimes increaſed to thirteen; or the neck, according as it is long or ſhort, ſometimes has eight pieces, or ſometimes only ſix.

General description of a vertebra.—The general form, proceſſes, and parts of the vertebra, are beſt exemplified in a vertebra of the loins; for in it the body is large, the proceſſes are right-lined, large, and ſtrong; the joint is complete, and all its parts are very ſtrongly marked. Every vertebra conſiſts of a body, which is firm for ſupporting the weight of the body, and hollow behind, for tranſmitting the ſpinal marrow; of two articulating proceſſes above, and two below, by which it is jointed with the bones which are above and below it; of two tranſverſe proceſſes, which ſtand out from either ſide of the bone, to give hold and purchaſe to thoſe muſcles which turn the ſpine; and of one proceſs, the ſpinous proceſs, which ſtands directly backwards from the middle of the bone; and theſe proceſſes being felt in diſtinct points all the way down the back, give the whole the appearance of a ridge; whence it has the name of ſpine.

1. The body of the vertebra is a large maſs of ſoft and ſpongy bone; it is circular before, and flat upon the ſides. It is hollowed into the form of a creſcent behind, to give the ſhape of that tube in which the ſpinal marrow is contained. The body has but a very thin ſcaly covering for its thick and ſpongy ſubſtance. It is tipped with a harder and prominent ring above and below, as a ſort of defence, and within the ring the body of the vertebra is hollowed out into a ſort of ſuperficial cup, which receives the ligamentous ſubſtance by which the two next vertebræ are joined to it; ſo that each vertebra goes upon a pivot, reſembles the ball and ſocket-joints; and in many animals it is diſtinctly a joint of this kind.

1. The BODY is the main part of the vertebra to which all the other proceſſes are to be referred; it is the centre of the ſpine, and bears chiefly the weight of the body: It is large in the loins, where the weight of the whole reſts upon it, and where the movements are rather free: It is ſmaller in the vertebræ of the back, where there is almoſt no motion, and leſs weight; and in the vertebræ of the neck, there is hardly any body; the vertebræ being joined to each other chiefly by the articulating proceſſes.

2. The ARTICULATING PROCESS is a ſmall projection, ſtanding out obliquely from the body of the vertebra, with a ſmooth ſurface, by which it is joined to the articulating proceſs of the next bone; for each vertebra has a double articulation; with that above and with that below. The bodies of the vertebræ are united to each other by a kind of ligament, which forms a more fixed, and rather an elaſtic joining; and they are united again by the articulating proceſſes; which makes a very moveable joint of the common form. The articulating proceſſes are ſometimes named oblique proceſſes, becauſe they ſtand rather obliquely. The upper ones are named the aſcending oblique proceſſes, and the two lower ones are named the inferior or deſcending oblique proceſſes.

3. The SPINOUS PROCESSES are thoſe which project directly backwards, whoſe points form the ridge of the back, and whoſe ſharpneſs gives the name to the whole column. The body of each vertebra ſends out two arms, which, meeting behind, form an arch or canal for the ſpinal marrow; and from the middle of that arch, and oppoſite to the body, the ſpinous proceſs

projects. Now theſe ſpinous, and the tranſverſe proceſſes, are as ſo many handles and levers by which the ſpine is to be moved; which, by their bigneſs, give a firm hold to the muſcles; and, by their length, give them a powerful lever to work their effects by. The ſpinous proceſſes, then, are for the inſertion of theſe muſcles which extend and raiſe the ſpine.

4. The TRANSVERSE PROCESSES ſtand out from the ſides of the arms or branches which form this arch. They ſtand out at right angles, or tranſverſely from the body of the bone; and they alſo are as levers, and long and powerful ones for moving and turning the ſpine. Perhaps their chief uſe is not for turning the vertebræ; for there is no proviſion for much of a lateral motion in the lower part of the ſpine, but the muſcles which are implanted into theſe are more commonly uſed in aſſiſting thoſe which extend and raiſe the ſpine.

Theſe, and all the proceſſes, are more diſtinct, prominent, and ſtrong, more direct, and larger in the loins, and more eaſily underſtood, than in the vertebræ of any other claſs. But this prepares only for the deſcription of the individual vertebræ, where we find a variety proportioned to the various offices, and to the degrees of motion which each claſs has to perform.

OF THE VERTEBRÆ OF THE LOINS.—I have choſen to repreſent the general form of a vertebra, by deſcribing one from the loins, becauſe of the diſtinctneſs with which all its parts are marked. In the lumber vertebræ, the perpendicular height of the body is ſhort; the intervertebral ſubſtance is thicker than in the other parts of the ſpine; and the ſeveral proceſſes ſtand off from each other diſtinct and clear; all which are proviſions for a freer motion in the loins.

The BODY of a lumbar vertebra is particularly large, thick, and ſpongy; and its thin outer plate is perforated by many arteries going inwards to nouriſh this ſpongy ſubſtance of the bone. The length of the body is an inch, and the interſticial cartilage is nearly as long: ſo that the vertebræ of the loins preſent to the eye, looking from within the body, a large thick and maſſy column, fit for ſupporting ſo great a weight.

The SPINOUS PROCESS is ſhort, big, and ſtrong. It runs horizontally and directly backwards from the arch of the ſpinal marrow. It is flattened, and about an inch in breadth; and it is commonly terminated by a lump or knob, indicating the great ſtrength of the muſcles which belong to it, and the ſecure hold which they have.

The TRANSVERSE PROCESS is alſo ſhort, direct, and very ſtrong; going off horizontally from the ſide of the bone; terminated like the ſpinous, by a knotty point, where large muſcles are implanted.

The ARTICULATING PROCESSES of the lumbar vertebræ ſtand ſo directly upwards and downwards, that the name of oblique proceſſes cannot be applied here.

Of the VERTEBRÆ OF THE BACK.—The character of the vertebræ of the back is directly oppoſite to that of the loins. The BODIES of the vertebræ are ſtill large to ſupport the great weight of the trunk; but they are much longer than in the loins, and their intervertebral ſubſtance is thin, for there is little motion here. The SPINOUS PROCESSES in the vertebræ of the back, are very long and aquiline. They are broad at their baſis, and very ſmall or ſpinous at their further end; and in place of ſtanding perpendicularly out from the body, they are ſo bent down, that they do not form a prominent nor unſightly ſpine, but are ranged almoſt in a perpendicular line; that is, laid over each other, like the ſcales of armour, the one above touching the one below, by which the motions of theſe vertebræ are ſtill further abridged. And, laſtly, the TRANSVERSE PROCESSES, which are ſhort and knobby, in place of ſtanding free and clear out, like thoſe of the loins, are tramelled and reſtricted from motion, by their connection with the ribs; for the ribs are not merely implanted upon the bodies of the dorſal vertebræ, but they are further attached firmly by ligaments, and by a regular joint to the tranſverſe proceſs of each vertebra. Now the rib being fixed to the body of one vertebra, and to the tranſverſe proceſs of the vertebra below, the motions of the vertebræ are much curbed. And we alſo get another mark by which the dorſal vertebræ may be known, viz. that each vertebra bears two impreſſions of the rib which was joined to it, one on the flat ſide of its body, and the other on the fore part of its tranſverſe proceſs.

Of the VERTEBRÆ OF THE NECK.—The vertebræ of the neck depart ſtill farther from the common form. Their BODIES are flattened on their fore parts, ſo as to make a flat ſurface on which the windpipe and gullet lie ſmooth. The BODY is very ſmall in all the vertebræ of the neck. In the uppermoſt of the neck there is abſolutely no body; and the next to that has not a body of the regular and common form. There is not in the vertebræ of the neck, as in thoſe of the loins, a cup or hollow for receiving the intervertebral ſubſtance, but the ſurfaces of the body are flat or plain, and the articulating proceſſes are oblique, and make as it were one articulation with the body; for the lower ſurface of the body being not hollow, but plain, and inclined forwards, and the articulating proceſſes being alſo plain, and inclined backwards, the two ſurfaces are oppoſed to each other, and the one prevents the vertebra from ſliding forwards, and the other prevents it from ſliding backwards, while a pretty free and general motion is allowed. The SPINOUS PROCESSES of the neck are for the inſertion of many muſcles, and therefore they are ſplit. This bifurcation of the ſpinous proceſs is not abſolutely peculiar to the cervical vertebræ; for ſometimes, though rarely, the others are ſo: and it is only in the middle of the neck that even they are forked; for the firſt vertebra is a plain ring, without any tranſverſe proceſs, becauſe there are few muſcles attached to it; and the laſt vertebra of the neck is ſcarcely bifurcated, approaching to the nature of the dorſal vertebræ; for it is long and aquiline; is depreſſed towards the back, and is ſo much longer than the others, as to be diſtinguiſhed by the name of VERTEBRA PROMINENS.

The TRANSVERSE PROCESSES of the neck are alſo bifurcated, becauſe there are a great many ſmall muſcles inſerted into them alſo. But the moſt curious peculiarity of the tranſverſe proceſſes is, that each of them is perforated for the tranſmiſſion of the great artery, which is named VERTEBRAL ARTERY, becauſe it paſſes through theſe holes in the vertebræ which form altogether a bony canal for the artery. This artery, which is defended with ſo much care, is one of the chief arteries of the brain, for there are two only ; and often when the other, the carotid, has been obſtructed, this continues to perform its office.

So that the character of theſe cervical vertebræ is, that they are calculated for much free motion : and the marks by which they are diſtinguiſhed are, that the bodies are particularly ſmall ; the articulating proceſſes oblique, with regard to their poſition, and almoſt plain on their ſurface : the ſpinous proceſs, which is awanting in the uppermoſt vertebra, is ſhort and forked in all the lower ones ; the tranſverſe proceſs alſo is forked ; and the tranſverſe proceſſes of all the vertebræ, except perhaps the firſt, are perforated near their extremities with the large hole of the vertebral artery.

ATLAS AND DENTATUS.—But among theſe vertebræ of the neck, two are to be particularly diſtinguiſhed, as of greater importance than all the reſt ; for though the five lower vertebræ of the neck be oſſified and fixed, if but the two uppermoſt remain free, the head, and even the neck, ſeems to move with perfect eaſe.

The firſt vertebra is named ATLAS, perhaps, becauſe the globe of the head is immediately placed upon it ; the ſecond is named DENTATUS or axis, becauſe it has an axis or tooth-like proceſs upon which the firſt turns.

The ATLAS has not the complete form of the other vertebræ of the neck, for its proceſſes are ſcarcely diſtinguiſhable : It has no body, unleſs its two articulating proceſſes are to be reckoned as a body : It is no more than a ſimple ring; it has no ſpinous proceſs; and its tranſverſe proceſs is not forked. The BODY is entirely awanting: in its place, the vertebra has a flat ſurface looking backwards, which is ſmooth and poliſhed by the rolling of the tooth-like proceſs; there is alſo a ſharp point riſing perpendicularly upwards towards the occipital bone, and this point is held to the edge of the occipital hole by a ſtrong ligament. The ſmooth mark of the tooth-like proceſs is eaſily found; and upon either ſide of it there projects a ſmall point from the inner circle of the ring. Theſe two points have a ligament extended betwixt them, called the tranſverſe ligament; which, like a bridge, divides the ring into two openings; one, the ſmaller, for lodging the tooth-like proceſs, embracing it cloſely; the greater opening is for the ſpinal marrow: The ligament confines the tooth-like proceſs; and when the ligament is burſt by violence (as has happened), the tooth-like proceſs, broken looſe, preſſes upon the ſpinal marrow; the head, no longer ſupported by it, falls forward, and the patient dies.

The ARTICULATING PROCESS may be conſidered as the body of this vertebra; for it is at once the only thick part, and the only articulating ſurface. This broad articulating ſubſtance is in the middle of each ſide of the ring: it has two ſmooth ſurfaces on each ſide, one looking upwards, by which it is joined to the occiput; and one looking directly downwards, by which it is joined to the ſecond vertebra of the neck. The two upper articulating ſurfaces are oval, and ſlightly hollow to receive the occipital condyles: they are alſo oblique, for the inner margin of each dips downwards;

the outer margin riſes upwards; and the fore end of each oval is turned a little towards its fellow. Now, by the obliquity of the condyles, and this obliquity of the ſockets which receive them, all rotatory motion is prevented; and the head performs, by its articulations with the firſt vertebra or atlas, only the nodding motions; and when it rolls, it carries the firſt vertebra along with it, moving round the tooth-like proceſs of the dentatus. The articulation with the head is a hinge joint in the ſtricteſt ſenſe: it allows of no other motion than that backwards and forwards. The nodding motions are performed by the head upon the atlas; the rotatory motions are performed by the atlas moving along with the head, turning upon the tooth-like proceſs of the dentatus.

Now the upper articulating ſurface of the atlas is hollowed to ſecure the articulation with the head; but the lower articulation, that with the dentatus, being ſecured already by the tooth-like proceſs of that bone, no other property is required in the lower articulating ſurface of the atlas, than that it ſhould glide with perfect eaſe: for which purpoſe it is plain and ſmooth; it neither receives, nor is received into the dentatus by any hollow, but lies flat upon the ſurface of that bone. It is alſo evident, that ſince the office of the atlas is to turn along with the head, it could not be fixed to the dentatus, in the common way, by a body and by intervertebral ſubſtance: and ſince the atlas attached to the head moves along with it, turning as upon an axis, it muſt have no SPINOUS PROCESS; for the projection of a ſpinous proceſs muſt have prevented its turning upon the dentatus, and would even have hindered, in ſome degree, the nodding of the head; therefore the atlas has a ſimple ring behind, and has only a ſmall knob or button where the ſpinous proceſs ſhould be. The TRANSVERSE PROCESS is not forked, but it is perforated with a large hole for the vertebral artery; and the artery to get into the ſkull makes a wide turn, lying flat upon the bone, by which there is a ſlight hollow or impreſſion of the artery, which makes the ring of the vertebra exceedingly thin.

But the form of the dentatus beſt explains theſe peculiarities of the atlas, and this turning of the head.

The DENTATUS or AXIS, is ſo named from its projecting point, which is the chief characteriſtic of this bone. When the dentatus is placed upright before us, we obſerve, 1. That it is moſt remarkably conical; riſing all the way upwards, by a gradual ſlope, to the point of its tooth-like proceſs. 2. That the ring of the vertebra is very deep, that is, very thick in its ſubſtance; and that the opening of the ring for tranſmitting the ſpinal marrow is of a triangular form. 3. That its ſpinous proceſs is ſhort, thick, and forked; and that it is turned much downwards, ſo as not to interfere, in any degree, with the rotation of the atlas. 4. That its tooth-like proceſs, from which the bone is named, is very large, about an inch in length; very thick, like the little finger; that it is pointed; and that from this rough point a ſtrong ligament goes upwards, by which the tooth is tied to the great hole of the occipital bone. We alſo obſerve a neck or collar, or ſmaller part, near the root of the tooth-like proceſs, where it is graſped by the ring of the atlas; while the point ſwells out a little above; ſo that without the help of ligaments it is almoſt locked in its place: we find this neck particularly ſmooth, for it is indeed upon this collar that the head continually turns. And, 5. We ſee on either ſide of this tooth-like proceſs a broad and flat articulating ſurface, one on either ſide. Theſe articulating ſurfaces are placed like ſhoulders; and the atlas being threaded by the tooth-like proceſs of the dentatus, is ſet flat down upon the high ſhoulders of this bone, and there it turns and performs all the rotatory motions of the head.

OF THE MEDULLARY TUBE, AND THE PASSAGE OF THE NERVES.—All the vertebræ conjoined make a large canal of a triangular or roundiſh form, in which the ſpinal marrow lies, giving off and diſtributing its nerves to the neck, arms, and legs: And the whole courſe of the canal is rendered ſafe for the marrow, and very ſmooth by lining membranes; the outermoſt of which is of a leather-like ſtrength and thickneſs, and ſerves this double purpoſe, that it is at once a hollow ligament, the whole length of the ſpine upon which the bones are threaded, and by which each individual bone is tied and fixed to the next; and it is alſo a vagina or ſheath which contains the ſpinal marrow, and which is bedewed on its internal ſurface with a thin exudation, keeping the ſheath moiſt and ſoft, and making the encloſed marrow lie eaſy and ſafe.

All down the ſpine this ſpinal medulla is giving off its nerves. One nerve paſſes from it at the interſtice of each vertebra; ſo that there are twenty-four nerves of the ſpine; or rather forty-eight nerves, twenty-four being given towards each ſide. Theſe nerves paſs each through an opening or ſmall hole in the general ſheath, and then they paſs through the interſtice of each vertebra; ſo that there is no hole in the bone required, but the nerve eſcapes by going under the articulating proceſs. This, indeed, is converted into ſomething like a hole when the two contiguous vertebræ are joined to each other.

THE INTERVERTEBRAL SUBSTANCE.—The intervertebral ſubſtance is that which is interpoſed betwixt the bodies of two adjoining vertebræ, and which is (at leaſt in the loins) nearly equal in thickneſs to the body of the vertebra to which it belongs. We give it this undefined name, becauſe there is nothing in the human ſyſtem to which it is entirely ſimilar; for it is not ligament, nor is it cartilage, but it is commonly defined to be ſomething of an intermediate nature. It is a ſoft and pliant ſubſtance, which is curiouſly folded and returned upon itſelf, like a rolled bandage with folds, gradually ſofter towards the centre, and with the rolled edges as if cut obliquely into a ſort of convex. The cut edges are thus turned towards the ſurface of the vertebra, to which the intervertebral ſubſtance belongs: It adheres to the face of each vertebra, and it is confined by a ſtrong ligament all round. And this ſubſtance, though it ſtill keeps its hold on each of the two vertebræ to which it belongs; though it permits no true motion of one bone on another, but only by a twiſting of its ſubſtance; yields, nevertheleſs, eaſily to which ever ſide we incline, and returns in a moment to its place by a very powerful reſilition. This perfect elaſticity is the chief characteriſtic and virtue of this intervertebral ſubſtance; whoſe properties indeed are beſt explained by its uſes; for in the bendings of the body, it yields in a very conſiderable degree, and riſes on the moment that the weight or the force of the muſcles is removed. In leaping, in ſhocks, or in falls, its elaſticity prevents any harm to the ſpine, while other leſs important joints are luxated and deſtroyed. During the day, it is continually yielding under preſſure; ſo that we are an inch taller in the morning than at night; we are ſhorter in old age than in youth; and the aged ſpine is bended forwards by the yielding of this part. Theſe curious facts were firſt obſerved by a ſort of chance, and have ſince been aſcertained with particular care.

Since preſſure, in length of years, ſhortens the fore part of the column of the ſpine, and makes the body ſtoop, any undue inclination to either ſide will cauſe diſtortion: the ſubſtance yields on one ſide, and riſes on the other; and at laſt the ſame change happens in the bones alſo, and the diſtortion is fixed, and not to be changed. This is peculiarly apt to happen with children whoſe bones are growing, and whoſe griſtles and intervertebral ſubſtances are peculiarly ſoft; ſo that a tumor on the head or jaw, which makes a boy carry his head on one ſide, or conſtant ſtooping, ſuch as is uſed by a girl in working at the tambour, or the carrying of a weakly child always on one arm by a negligent or awkward nurſe, will cauſe in time a fixed incurable diſtortion.

We are now qualified to underſtand the motions of the vertebræ, and to trace the degree of motion in each individual claſs. The degrees of motion vary with the forms of the vertebra in each part of the ſpine: the motion is freeſt in the neck; more limited in the loins; and in the back (the middle part of the ſpine) ſcarcely any motion is allowed. The head performs all the nodding motions upon the firſt vertebra of the neck: the firſt vertebra of the neck performs again all the quick and ſhort turnings of the head, by moving upon the dentatus: all the lower vertebræ of the neck are alſo tolerably free, and favour theſe motions by a degree of turning; and all the bendings of the neck are performed by them. The dorſal vertebræ are the moſt limited in their movements; bending chiefly forwards by the yielding of their intervertebral ſubſtance. The vertebræ of the loins again move largely, for their intervertebral ſubſtance is deep, and their proceſſes quite unentangled and free. To perform theſe motions, each vertebra has two diſtinct joints, as different in office as in form: firſt, each vertebra is fixed to thoſe above and below by the intervertebral ſubſtance, which adheres ſo to each that there is no true motion: there is no turning of any one vertebra upon the next; but the elaſticity of the intervertebral ſubſtance allows the bones to move a little, ſo that there is a general twiſting and gentle bending of the whole ſpine. The ſecond joint is of the common nature with the other joints of the body, for the articulating proceſſes are faced with cartilage, ſurrounded with a capſule, and lubricated with a mucus. And I conceive this to be the intention of the articulating proceſſes being produced to ſuch a length, that they may lap over each other to prevent luxations of the ſpine; and they muſt, of courſe, have theſe ſmall joints, that they may yield to this general bending of the ſpine.

THORAX.

Of the ribs.—The ribs, whoſe office it is to give form to the thorax, and to cover and defend the lungs, alſo aſſiſt in breathing; for they are joined to the vertebræ by regular hinges, which allow of ſhort motions, and to the ſternum by cartilages, which yield to the motion of the ribs, and return again when the muſcles ceaſe to act.

Each rib, then, is characteriſed by theſe material parts: a great length of bone; at one end of which there is a head for articulation with the vertebræ, and a ſhoulder or knob for articulation with its tranſverſe proceſs; at the other end there is a point, with a ſocket for receiving its cartilage, and a cartilage joined to it, which is implanted into a ſimilar ſocket in the ſide of the ſternum, ſo as to complete the form of the cheſt.

The ribs are twelve in number, according to the number of the vertebræ in the back. Of theſe ſeven are named true ribs, becauſe their cartilages join directly with the ſternum; and five are named falſe ribs, becauſe their cartilages are not ſeparately nor directly implanted into the ſternum, but are joined one with another; the cartilage of the lower rib being joined, and loſt in that of the rib above, ſo that all the lower ribs run into one greater cartilage. But there is ſtill another diſtinction, viz. that the laſt rib, and commonly alſo the rib above, is not at all implanted in the ſternum, but is looſely connected only with the muſcles of the abdomen, whence it is named the looſe or floating rib.

The ribs are, in general, of a flattened form, their flat ſides being turned ſmooth towards the lungs. But this flatneſs of the rib is not regular; it is contorted, as if the ſoft rib had been ſeized by either end, and twiſted betwixt the hands: the meaning of which is, to accommodate the flatneſs of the rib to the form which the thorax aſſumes in all its degrees of elevation; for when the rib riſes, and during its riſing through all the degrees of elevation, it ſtill keeps its flat ſide towards the lungs. Though of a flattened form, the rib is a little rounded at its upper edge; is ſharp and cutting at its lower edge; and its lower edge ſeems double, for there is a groove made there by the intercoſtal artery and nerve. They are named intercoſtal, from lying betwixt the ribs. The artery being rather within the rib, is defended in ſome degree by its groove; the lip of which forms the lower edge of the rib: but ſtill this artery is not without reach of the knife, in ſome ſurgical operations. We are careful, therefore, to mark, that it runs on the lower edge of the rib, and is of the ſize of a crow-quill; and that, if it be wounded, it will bleed largely, from its nearneſs to the greateſt artery of the body; that it is eaſily ſhunned, by keeping the knife nearer to the rib below.

On each rib we find the following parts: 1. The HEAD, or round knob by which it is joined to the ſpine. The head of each rib has indeed but a ſmall articulating ſurface; but that ſmooth ſurface is double, or looks two ways. For the head of the rib is not implanted into the ſide of one vertebra; it is rather implanted

planted into the interſtice betwixt two vertebræ; the head touching both vertebræ; and each vertebra bearing the mark of two ribs, one above, and one below. The mark of the rib is on the edge of either vertebra, and the ſocket may be ſaid to lie in the intervertebral ſubſtance betwixt them.

2. The NECK of the rib is a ſmaller part, immediately before the head. Here the rib is particularly ſmall and round.

3. About an inch from the head, there is a ſecond riſing, or bump, the articulating ſurface, by which it touches and turns upon the tranſverſe proceſs. Theſe two articulations have each a diſtinct capſule or bag; each is a very regular joint; and the degree of motion of the rib, and direction in which it moves, may be eaſily calculated, from the manner in which it is jointed with the ſpine. For the two articulating ſurfaces of the rib are on its back part; the back of the rib is ſimply laid upon the ſide of the ſpine; the joints, with the body of the vertebræ, and with its tranſverſe proceſs, are in one line, and form as if but one joint; ſo that the rib being fixed obliquely, and at one end only, that end continues firm, except in turning upon its axis; the two heads roll upon the body of the vertebræ, and upon the tranſverſe proceſs; and ſo its upper end continues fixed, while its lower end riſes or falls; and as the motion is in a circle, the head being the central point, moves but little, while the lower end of the rib has the wideſt range.

4. Juſt above the ſecond articulating ſurface, there is a third tubercle, which has nothing to do with the joints, but is intended merely for the attachment of the

ligaments and muſcles from the ſpine, which ſuſpend and move the rib.

5. The angle of the rib is often mentioned, being a common mark for the place of ſurgical operations. There is a flatneſs of the thorax behind, forming the breadth of the back; the ſharpneſs where this flatneſs begins to turn into the roundneſs of the cheſt, is formed by the angles of the ribs. Each rib is round in the place of its head, neck, and tubercles; it grows flatter a little, as it approaches the angle; but it is not completely flattened till it has turned the angle which is the proper boundary betwixt the round and the flat parts of the rib.

It is very evident that this anatomy of the ribs is neither difficult nor important. It is in ſome degree uſeful, in the more advanced parts of anatomy, to remember the names; and it is neceſſary, even in ſpeaking the common language of ſurgeons, to know theſe parts, viz. the head of the rib; the tubercle, or ſecond articulating ſurface; the angle, or turning forward of the rib; the upper round, and the lower flat edge; and eſpecially to remember the place and the dangers of the intercoſtal artery. But there are ſome peculiarities in individual ribs; the chief of which are theſe: The ſize or length of the ribs gradually decreaſes from the firſt to the laſt, the firſt being exceedingly ſhort and circular, the lower ones longer, and almoſt right-lined; ſo that the thorax is altogether of a conical ſhape, the upper opening ſo ſmall, as juſt to permit the trachea, œſophagus, and great veſſels, to paſs; the lower opening ſo large, that it equals the diameter of the abdomen: The firſt rib is conſequently very ſhort; it is thick, ſtrong, and of a flattened form; of which flatneſs one face looks upwards, and another downwards: and the great axillary artery and vein lie upon its flat upper ſurface. It is alſo particularly circular, making more than half a circle from its head to the extremity, where it joins the ſternum; it has, of courſe, no angle, and wants the diſtorted twiſting of the other ribs. The ſecond rib is alſo round, like the firſt rib. The eleventh and twelfth, or the floating ribs, are exceedingly ſmall and delicate; and their cartilage terminates in an acute point, unconnected with the ſternum. And, laſtly, the heads of the firſt, and of the eleventh and twelfth ribs, are rounder than any of the others; for theſe three have their heads implanted into the flat ſide of one vertebra only; while all the others have theirs implanted betwixt the bodies of two vertebræ.

The cartilages of the ribs complete the form of the thorax, and form all the lunated edge of that cavity; and it is from this cartilaginous circle that the great muſcle of the diaphragm has its chief origin, forming the partition betwixt the thorax and the abdomen. The farther end of each rib ſwells out thick and ſpongy, and has a ſmall ſocket for lodging the cartilage; for theſe cartilages are not joined like the intervertebral ſubſtances with their bones; but there is a ſort of joint very little moveable indeed, but ſtill having a rude ſocket, and a ſtrong capſular ligament, and being capable of luxation by falls and blows; and the implantations into the ſternum are evidently by fair round ſockets, which are eaſily diſtinguiſhed upon the two edges of that bone. Theſe cartilages may be enumerated thus. The cartilages of the firſt and ſecond ribs deſcend to touch the ſternum. The cartilage of the third rib is direct. The cartilages of the fourth, fifth, and ſixth ribs riſe upwards, in proportion to their diſtance from this central one. The firſt five ribs have independent cartilages; the eighth, ninth, and tenth ribs run their cartilages into the cartilage of the ſeventh rib; and the eleventh and twelfth ribs have their cartilages ſmall, unconnected, and floating looſe.

The sternum.—The ſternum is that long and ſquared bone, which lies on the fore part of the breaſt over the heart, and which being joined by the cartilages of the ribs, completes the cavity of the cheſt; it is for completing the thorax, and defending the heart; for a medium of attachment to the ribs; and for a fulcrum or point, on which the clavicles may roll.

We find the ſternum conſiſting in the child of eight diſtinct pieces; which run together in the progreſs of life; and which in old age are firmly united into one: but in all the middle ſtage of life, we find three pieces in the ſternum, two of which are properly bone, the third remains a cartilage till very late in life, and is named the enſiform cartilage, from its ſword-like point.

It is found to have eight pieces, even in the child of ſix years old; ſome years after, it has but five or ſix; at laſt but two only; and the ſalient white lines, which traverſe the bone, mark where the intermediate cartilages have once been.

1. The upper piece of the ſternum is very large, roundiſh, or rather triangular, reſembling the form of the heart on playing cards. It is about two inches in length, and an inch and a half in breadth; and theſe

marks are eaſily obſerved; the APEX, or point of the triangle, is pointed downwards, to meet the ſecond bone of the ſternum: The BASE OF THE TRIANGLE, which is uppermoſt, towards the root of the throat ſeems a little hollowed, for the trachea paſſing behind it: On each upper corner, it has a large articulating hollow, into which the ends of the collar bones are received; (for this bone is the ſteady fulcrum upon which they roll). A little lower than this, and upon its ſide, is the ſocket for receiving the ſhort cartilage of the firſt rib; and the ſecond rib is implanted in the interſtice between the firſt and ſecond bone of the ſternum; ſo that one half of the ſocket for its cartilage is found in the lower part of this bone, and the other half in the upper end of the next.

2. The ſecond piece of the ſternum is of a ſquare form; very long and flat; and compoſing the chief length of the ſternum: for the firſt piece receives only the cartilage of the firſt rib, and one half of the ſecond; but this long piece receives, on each ſide or edge of it, the cartilages of eight ribs; but as three of the lower cartilages are run into one, there are but five ſockets or marks. The ſockets for receiving the cartilages of the ribs are on the edges of the ſternum; they are very deep in the firm ſubſtance of the bone, and large enough to receive the point of the finger with eaſe: And whoever compares the ſize and deepneſs of theſe ſockets, with the round heads of the cartilages which enter into them, will no more doubt of diſtinct joints here, than of the diſtinct articulation of the vertebræ with each other.

3. This is in truth the whole of the bony ſternum; and what is reckoned the third piece, is a carti-

lage merely, and continues ſo down to extreme old age. This cartilage, which ekes out and lengthens the ſternum, and which is pointed like a ſword, is thence named CARTILAGO MUCRONATA, the pointed cartilage; or CARTILAGO ENSIFORMIS, or IXPHOIDES, the ſword-like cartilage. This cartilaginous point extending downwards over the belly, gives a ſure origin, and greater power to the muſcles of the abdomen; and that without embarraſſing the motions of the body. But this cartilage, which is commonly ſhort and ſingle pointed, is ſometimes forked; ſometimes bent inwards, ſo (it has been thought) as to occaſion ſickneſs and pain; and in one caſe was found of ſuch a length, as to reach the navel, and oſſified at the ſame time, ſo as to hinder the bending of the body, and occaſion much diſtreſs.

The ſternum, and the ribs, and all the cheſt, ſtand ſo much expoſed, that did we not naturally guard them with the hands, fractures muſt be very frequent; but indeed when they are broken and beaten in, they hurt the heart or lungs, and not unfrequently the moſt dreadful conſequences enſue. I have already explained, that this claſs of bones, defending the moſt noble viſcera (next to the brain), the injuries are almoſt as fatal as injuries of the brain. Often by a wheel paſſing over the body, the ſternum is broken; its pieces preſs inwards upon the heart, which is ſometimes burſt; but more commonly the patient dies a ſlow and miſerable death; for the inflammation, which begins in the place of the wound, is extended to the lungs; is propagated ſtill onwards to the heart; and the heart being once inflamed, there comes anxiety, oppreſſion, faintings, and palpitations; anxious breathing; quick and interrupted pulſe; ſtill more frequent faintings, and then death. The ribs cover more properly the lungs; where the wound or inflammation is not always fatal: for the wound by the point of the rib is no deeper than juſt to puncture the lungs; yet through this ſmall wound on their ſurface, the lungs breathe out their air into the cavity of the cheſt, and at laſt it eſcapes under the cellular ſubſtance of the ſkin; the man is blown up to a prodigious degree, with continually increaſing anxiety; his breathing becomes more and more interrupted; and if not aſſiſted, he muſt die.

PELVIS.

To give a ſteady bearing to the trunk, and to connect it with the lower extremities, by a ſure and firm joining, the pelvis is interpoſed. It is a circle of large and firm bones, ſtanding as an arch betwixt the lower extremities and the trunk. Its arch is wide and ſtrong, ſo as to give a firm bearing to the body; its individual bones are large, ſo as to give a deep and ſure ſocket for the implantation of the thigh-bone; its motions are free and large, bearing the trunk above, and rolling upon the thigh-bones below; and it is ſo truly the centre of all the great motions of the body, that when we believe the motion to be in the higher parts of the ſpine, it is either the laſt vertebra of the loins bending upon the top of the pelvis, or the pelvis itſelf rolling upon the head of the thigh-bones.

The PELVIS is named partly, perhaps, from its reſembling a baſin in its form; or perhaps, from its office of containing the urinary bladder, rectum, vagina, and womb. It conſiſts, in the child, of many pieces; but in the adult, it is formed of four large bones, of the os ſacrum behind, the oſſa innominata on either ſide, and the os coccygis below.

Os SACRUM. The names os ſacrum, os baſilare, &c. ſeem to relate rather to the greater ſize of this bone, than to its ever having been offered in ſacrifice. This bone, with its appendix the os coccygis, is called the falſe ſpine, or the column of the falſe vertebræ; authors making this diſtinction, that the true vertebræ are thoſe of the back, neck, and loins, a column which grows gradually ſmaller upwards; the falſe vertebræ are thoſe of the ſacrum and coccyx, which are conical, with the apex or point downwards, and the baſe, viz. the top of the ſacrum, turned upwards to meet the true ſpine.

The bones of which the ſacrum is compoſed, have originally the form of diſtinct ſmall vertebræ. Theſe diſtinctions are loſt in the adult, or are recognized only by the marks of former lines; for the original vertebræ are now united into one large and firm bone, which is named the column of falſe vertebræ; becauſe, having no motion, it wants the chief character and uſe of the true ones.

We can recognize the original vertebræ even in the adult bone, for we find it regularly perforated with holes for the tranſmiſſion of the ſpinal nerves; we find theſe holes regularly diſpoſed in pairs; we ſee a diſtinct white and riſing line which croſſes the bone, in the interſtice of each of the original vertebræ, and marks the place where the cartilage once was; and by theſe lines being five in number, with five pairs of holes, we know this bone to have conſiſted once of five pieces, which are now joined into one. The remains of former proceſſes can alſo be diſtinguiſhed; and the back of the bone is rough and irregular from the old ſpines.

The os ſacrum, thus compoſed, is among the lighteſt bones of the human body; with the moſt ſpongy ſubſtance; the thinneſt tables; the moſt eaſily broken; and its injuries of the moſt formidable nature: but then it is a bone the beſt cemented; and confirmed by ſtrong ligaments; and the beſt covered by thick and cuſhion-like muſcles. The os ſacrum is of a triangular ſhape; the baſe of the triangle turned upwards to receive the ſpine; its inner ſurface is ſmooth, to permit the head of the child in labour to glide eaſily along; and its outer ſurface is irregular and rough, with the ſpines of former vertebra, giving riſe to the great glutæi muſcles (which form the contour of the hip), and to all the ſtrongeſt muſcles of the back and loins.

It has in it a triangular cavity under the arch of its ſpinous proceſſes; which cavity is continued from the canal in the vertebræ of the ſpine; and this cavity of the ſacrum contains the continuation and the end of the ſpinal marrow; which being in this place divided into a great many thread-like nerves, has altogether the form of a horſe's tail, and is therefore named cauda equina.

From this triangular cavity, the nerves of the cauda equina go out by the five great holes on the fore part of the ſacrum; holes large enough to receive the point of the finger. The three firſt nerves of the ſacrum, joining with the laſt nerve of the loins, form the ſacro-ſciatic nerve; the largeſt in the body; which goes downward to the leg: while the two lower nerves of the ſacrum ſupply the contents of the pelvis alone.

The back of the ſacrum is alſo perforated with holes, whoſe ſize is nearly equal to thoſe on its fore part, but whoſe uſes are not ſo diſtinctly known; for the ſmall nerves which paſs outwards by them to the muſcles of the loins or hips, are in no degree proportioned to the ſize of the holes.

All the edges of this triangle form articulating points, by which it is joined to other bones. The baſe, or upper part of the ſacrum, receives the laſt vertebra of the loins on a large broad ſurface, which makes a very moveable joint; and indeed, the joining of the laſt true vertebra, with the top of the ſacrum, is a point where there is more motion than in the higher parts of the ſpine. The apex, or point of the ſacrum, has the os coccygis joined to it; and this joining is moveable till the age of twenty in men, and till the age of forty-five in women:—the meaning of its continuing longer moveable in women is very plain, ſince we diſtinctly feel the lower point of the coccyx in women, yielding in the time of labour, ſo as to enlarge greatly the lower opening of the pelvis. The ſides of the os ſacrum form a broad, rough, and deeply indented ſurface, which receives the like rough ſurface of the haunch bones; and here the ſurfaces are ſo rough, and the cartilage ſo thin, that it reſembles more nearly a future; and by the help of the ſtrong ligaments, and of the large muſcles which ariſe in common from either bone, makes a joining abſolutely immoveable, except by ſuch violent force as is in the end fatal.

Thus the original ſtate of this bone is eaſily recogniſed and traced by many marks; it ſtands in a conſpicuous place of the pelvis, and its chief office is to ſupport the trunk; to which we may add, that it defends the cauda equina; tranſmits its great nerves; forms chiefly the cavity of the pelvis; and that it is along the hollow of this bone that the accoucheur calculates the progreſs of the child's head in labour.

The os COCCYGIS, ſo named from its reſemblance to the beak of a cuckow, is a ſmall appendage to the point of the ſacrum; terminating this inverted column with an acute point, and found in very different conditions in the ſeveral ſtages of life. In the child it is merely cartilage, and we can find no point of bone; during youth it is oſſifying into diſtinct bones, which continue moveable upon each other till manhood; then the ſeparate bones gradually unite with each other, ſo as to form one conical bone, with bulgings and marks of the pieces of which it was originally compoſed; but ſtill the laſt bone continues to move upon the joint of the ſacrum, till in advanced years it is at laſt firmly united; later in women than in men, with whom it is often fixed at twenty or twenty-five. It is not like the os ſacrum, flat, but of a roundiſh form, convex without and concave inwards; forming with the ſacrum the loweſt part of the pelvis behind. It has no holes like the ſacrum; has no communication with the ſpinal canal; and tranſmits no nerves; but points forwards to ſupport the lower parts of the rectum: thus, it contracts the lower opening of the pelvis, ſo as to ſupport effectually the rectum, bladder, and womb, and yet continues ſo moveable in women, as to recede in time of labour, allowing the head to paſs.

The OSSA INNOMINATA—Are the two great irregular bones, forming the ſides of the pelvis; and they have a form ſo difficult to explain by one name, that they are called oſſa innominata, the nameleſs bones. But theſe bones having been in the child formed in diſtinct and ſeparate pieces, theſe pieces retain their original names, though united into one great bone; we continue to explain them as diſtinct bones by the names of os ilium, os iſchium, and os pubis. The os ILIUM, the haunch-bone, is that broad and expanded bone on which lie the ſtrong muſcles of the thigh, and which forms the rounding of the haunch. The os ISCHIUM, the hip-bone, is the loweſt point of the pelvis, that on which we reſt in ſitting. The os PUBIS, or ſhare-bone, on which the private parts are placed. All theſe bones were divided in the child; they are united in the very centre of the ſocket for the thigh-bone; and we find in the child a thick cartilage in the centre of the ſocket, and a prominent ridge of bone in the adult; which ridge, far from incommoding the articulation with the thigh-bone, gives a firmer hold to the cartilage which lines that cavity, and is the point into which a ſtrong ligament from the head of the thigh-bone is implanted.

The os ILIUM, or haunch-bone, is named from its forming the flank. It is the largeſt part of the os innominatum. It riſes upwards from the pelvis in a broad expanded wing, which forms the lower part of the cavity of the abdomen, and ſupports the chief weight of the impregnated womb (for the womb commonly inclines to one ſide). The os ilium is covered with the great muſcles that move the thighs, and to its edge are fixed thoſe broad flat muſcles which form the walls of the abdomen. This flat upper part is named the ALA, or WING, while the lower, or rounder part, is named the BODY of the bone, where it enters into the ſocket, and meets the other bones.

The ALA, or flat expanded wing, has many parts, which muſt be well remembered, to underſtand the muſcles which ariſe from them. 1. The whole circle of this wing is tipt with a ridge of firmer bone, which encircles the whole. This is a circular cartilage in the child, diſtinct from the bone, and is oſſified and fixed only at riper years. All this ridgy circle is called the ſpine, and is the origin for the lower oblique and tranſverſe muſcles of the abdomen. 2. The two ends of this ſpine are abrupt, and the points formed upon it are conſequently named ſpinous proceſſes; of which there are two at its fore, and two at its back end. The two POSTERIOR SPINOUS PROCESSES are cloſe by each other, and are merely two rough projecting points near the rough ſurface, by which the os ilium is joined to the os ſacrum; they jut out behind the articulation, to make it firm and ſure; and their chief uſes ſeem to be the giving a firm hold to the ſtrong ligaments which bind this joint. 3. The two anterior ſpinous proceſſes are more diſtinct and more important marks; for the ANTERIOR SUPERIOR SPINOUS PROCESS is the abrupt ending of the ſpine or circle of the ilium, with a ſwelling out; from which jutting point the ſartorius muſcle, the longeſt and amongſt the moſt beautiful in the human body, goes obliquely acroſs the thigh, like a ſtrap, down to the knee; another, which is called the tenſor vaginæ femoris,

moris, alſo ariſes here : and from this point departs the ligament, which paſſing from the os ilium to the pubis, or fore point of the pelvis, is called the ligament of the thigh. How neceſſary it is to mark this point, may be eaſily deduced, from knowing that it is under the arch of this femoral ligament that the great artery paſſes down to the thigh, and that the femoral hernia is formed. The LOWER ANTERIOR ſpinous proceſs is a ſmall bump, or little ſwelling, about an inch under the firſt one, which gives riſe to the rectus femoris muſcle, or ſtraight muſcle of the thigh, which lies along its fore part.

The back, or DORSUM of the os ilium, is covered with the two great glutæi muſcles ; and the COSTA, as it is abſurdly called, or the inner concave ſurface, gives riſe to the internal iliac muſcle.

This bone (the os ilium) has a broad rough ſurface, by which it is connected with the os ſacrum at its ſide; the very form of which declares the nature of this joining, and is ſufficient argument and proof that the joinings of the pelvis do not move.

The acute line which is named LINEA INNOMINATA, is ſeen upon the internal ſurface of the bone, dividing the ala, or wing, from that part which is in the ſocket for the thigh. This line compoſes part of the brim of the pelvis ; diſtinguiſhes the cavity of the pelvis from the cavity of the abdomen ; and marks the circle into which the head of the child deſcends at the commencement of labour.

The os ISCHIUM, or hip-bone, is placed perpendicularly under the os ilium, and is the loweſt point of the pelvis, upon which we ſit. It forms the largeſt ſhare of the ſocket; whence the ſocket is named Acetabulum Iſchii, as peculiarly belonging to this bone. The bump or round ſwelling upon which we reſt, is named the Tuber Iſchii; and the ſmaller part, which extends upwards to meet the os pubis, is named the Ramus, or branch, which meets a ſimilar branch of that bone, to form the thyroid hole.

The BODY is the uppermoſt, and thicker part of the bone, which helps in forming the ſocket; and among the three bones this one forms the largeſt ſhare of it; nearly one half. From the body, a ſharp pointed proceſs, named SPINOUS PROCESS of the iſchium, is projected backwards; and this ſpinous proceſs pointing towards the lower end of the ſacrum, receives the uppermoſt of two long ligaments, which, from their paſſing betwixt the iſchium and ſacrum, are named ſacro-ſciatic. By this ligament a ſemicircle of the os ilium, juſt below the joining of the ilium with the ſacrum, is completed into a large round hole; which is in like manner named the ſacro-ſciatic hole, and gives paſſage to the great nerve of the lower exrremity, named the great ſacro-ſciatic nerve.

The TUBER, or round knob, being the point upon which we reſt, this bone has been often named OS SEDENTARIUM. The bump is a little flattened when we ſit upon it. It is the mark by which the lithotomiſt directs his inciſion; cutting exactly in the middle betwixt the anus and this point of bone. It is remarkable as the point towards which the poſterior or lower ſacro-ſciatic ligament extends; and as a point which gives riſe to ſeveral of the ſtrong muſcles on the back of the thigh, and eſpecially to thoſe which form the hamſtrings.

The RAMUS, or branch, riſes obliquely upwards and forwards, to join a like branch of the pubis. This branch, or arm as it is called, is flat, and its edges are turned a little forwards and backwards, ſo that one edge forms the arch of the pubis, while the other edge forms the margin of the thyroid hole.

The OS PUBIS, or SHARE-BONE, is the laſt and ſmalleſt piece of the os innominatum; and is named from the mons veneris being placed upon it, and its hair being a mark of puberty. It forms the upper or fore part of the pelvis, and completes the brim; and, like the iſchium, it alſo is divided into three parts, viz. the BODY, ANGLE, and RAMUS.

The BODY of the pubis is thick and ſtrong, and forms about one-fifth of the ſocket for the thigh bone. It is not only the ſmalleſt, but the ſhalloweſt part of the ſocket. The bone grows ſmaller as it advances towards its angle, the joining of the oſſa pubis. There it grows again broad and flat, and the two bones meet with rough ſurfaces, but with two cartilages interpoſed. Over the middle of this bone, two great muſcles, the iliac and pſoas muſcles, paſs out of the pelvis to the thigh; and where they run under the ligament of the thigh, they make the pubis very ſmooth. Along this bone there is a little edge, or ſharp ridge, which marks the brim of the pelvis; and the part which is over the ſymphyſis, or joining of the bones, riſing higher than the reſt of the ridge, is named the creſt of the pubis; and from this point the ſmall pyramidal muſcles of the abdomen riſe. The RAMUS, or branch, is that more ſlender part of the pubis, which, joining with the branch of the iſchium, forms with it the arch of the pubis, and the edge of the thyroid hole.

This completes the ſtrict anatomy of the pelvis: But when we conſider the whole, it is further neceſſary to repeat, in ſhort definitions, certain points which are oftener mentioned as marks of other parts.

The PROMONTORY of the ſacrum is the projection formed by the loweſt vertebra of the loins and the upper point of that bone. The HOLLOW of the ſacrum is all that ſmooth inner ſurface which gives out the great nerves for the legs and pelvis. The LESSER ANGLE, in diſtinction from the greater angle or promontory of the ſacrum, is a ſhort turn in the bone near where it is joined with the coccyx. The CREST of the PUBIS is a ſharper ridge or edge of the bone over the joining or ſymphyſis pubis. The POSTERIOR SYMPHYSIS of the pelvis is the joining of the ſacrum with the ilium, while the ſymphyſis pubis is diſtinguiſhed by the name of ANTERIOR-SYMPHYSIS of the pelvis. The SPINE, the TUBER, and the RAMUS of the iſchium are ſufficiently explained. The ALA, or wing, the SPINE, the SPINOUS PROCESSES, and the LINEA INNOMINATA of the ilium, are alſo ſufficiently explained. The ACETABULUM, ſo named from its reſemblance to a meaſure which the ancients uſed for vinegar, is the hollow or ſocket for the thigh-bone, compoſed of the ilium, iſchium, and pubis; the ridge in its centre ſhows the place of its original cartilage, and points out what proportion belongs to each bone; that it is made, two-fifths by the os ilium, two-fifths by the os iſchium, and one-fifth only by the os pubis: but the iſchium has the greateſt ſhare; the iſchium forming more than two-fifths, and the ilium leſs. The BRIM of the PELVIS is that oval ring which parts the cavity of the pelvis from the cavity of the abdomen: it is formed by a continued and prominent line along the upper part of the ſacrum, the middle of the ilium, and the upper part or creſt of the pubis. This circle of the brim ſupports the impregnated womb; keeps it up againſt the preſſure of the labour-pains; and ſometimes this line has been "as ſharp as a paper-"folder, and has cut acroſs the lower ſegment of the "womb;" and ſo, by ſeparating the womb from the vagina, has rendered the delivery impoſſible; and the child eſcaping into the abdomen among the inteſtines, the woman has died. The OUTLET of the PELVIS is the lower circle again, compoſed by the arch of the pubis, and by the ſciatic ligaments, which is wide and dilatable, to permit the delivery of the child; but which, being ſometimes too wide, permits the child's head to preſs ſo ſuddenly, and with ſuch violence, upon the ſoft parts, that the perineum is torn. The THYROID HOLE is that remarkable vacancy in the bone which perhaps lightens the pelvis, or perhaps allows the ſoft parts to eſcape from the preſſure during the paſſage of the head of the child.

The marks of the female ſkeleton have been ſought for in the ſkull, as in the continuation of the ſagittal ſuture; but the trueſt marks are thoſe which relate to that great function by which chiefly the ſexes are diſtinguiſhed: for while the male pelvis is large and ſtrong, with a ſmall cavity, narrow openings, and bones of greater ſtrength; the female pelvis is very ſhallow and wide, with a large cavity and ſlender bones, and with every peculiarity which may conduce to the eaſy paſſage of the child. And this occaſions that peculiar form of the body which the painter is at greater pains to mark, and which is indeed very eaſily perceived: for the characteriſtic of the manly form is firmneſs and ſtrength; the ſhoulders broad, the haunches ſmall, the thighs in a direct line with the body, which gives a firm and graceful ſtep. The female form again is delicate, ſoft, and bending; the ſhoulders are narrow; the haunches broad; the thighs round and large; the knees, of courſe, approach each other, and the ſtep is unſure: The woman, even of the moſt beautiful form, walks with a delicacy and feebleneſs, which we come to acknowledge as a beauty in the weaker ſex.

The bones of the pelvis compoſe a cavity which cannot be fairly underſtood in ſeparate pieces, but which ſhould be explained as a whole. Though perhaps its chief office is to ſupport the ſpine, ſtill its relation to labour deſerves to be obſerved; for this forms at leaſt a curious inquiry, though it ſhould not be allowed a higher place in the order of uſeful ſtudies.

We know, from much experience, that where the pelvis is of the true ſize, we have an eaſy and natural labour: that where the pelvis is too large, there is pain and delay; but not that kind of difficulty which endangers life: that where, by diſtortion, the pelvis is reduced below the ſtandard ſize, there comes ſuch difficulty as endangers the mother, and deſtroys the child, and renders the art of midwifery ſtill worthy of ſerious ſtudy, and an object of public care.

There was a time when it was univerſally believed, that the joinings of the pelvis diſſolved in every labour; that the bones parted, and the openings were enlarged; that the child paſſed with greater eaſe; and "that this opening of the baſin was no leſs natu-"ral than the opening of the womb." By many accidents, this opinion has been often ſtrengthened and revived; and if authority could determine our opinion, we ſhould acknowledge, that the joinings of the pelvis were always diſſolved, as a wiſe proviſion of nature for facilitating natural, and preventing lingering, labour, compenſating for the frequent deviations, both in the head and pelvis, from their true and natural ſize. This unlucky opinion has introduced, at one time, a practice the moſt reprehenſibly ſimple; as fomentations to ſoften theſe joinings of the pelvis in circumſtances which require very ſpeedy help; while, at another time, it has been the apology for the moſt cruel unnatural operations of inſtruments, not merely intended for dilating and opening the ſoft parts, but for burſting up theſe joinings of the bones. And thoſe alſo, of late years, who have invented and performed (too often no doubt) this operation of cutting the ſymphyſis pubis to haſten the labour, ſay, that they do not perform an unneceſſary cruel operation, but merely imitate a common proceſs of nature.

How very far nature is from intending this, may be eaſily known from the very forms of theſe joinings, but much more from the other offices which theſe bones have to perform; for if the pelvis be, as I have defined it, an arch ſtanding betwixt the trunk and the lower extremities on which the body rolls, its joinings could not part without pain and lameneſs, perhaps inability for life.

One chief reaſon drawn from anatomy is this: that in women dying after labour, the griſtles of the pelvis are manifaſtly ſoftened; the bones looſen; and though they cannot be pulled aſunder, they can be ſhuffled or moved upon each other in a ſlight degree: all which is eaſily accounted for. The griſtle that forms the ſymphyſis pubis is not one griſtle only, as was once ſuppoſed, but a peculiar griſtle covers the end of each bone, and theſe are join'd by a membranous or ligamentous ſubſtance: This ligamentous ſubſtance is the part which corrupts the ſooneſt; it is often ſpoiled, and in the place of it a hollow only is found; that hollow of the corrupted ligament may be called a ſeparation of the bones; but it is ſuch a ſeparation as "equals only the back of a common knife in breadth, "and will not allow the bones to depart from each "other;" the joining is ſtill ſtrong, for it is ſurrounded by a capſular ligament, not like the looſe ligament of a moveable joint, but adhering to every point of each bone: and this ligament does perform its office ſo completely, that while it remains entire, though the bones ſhuffle ſidewiſe upon each other, no force can pull them aſunder: "Even when the fore part of the "pelvis is cut out, and turned and twiſted betwixt the "hands, ſtill though the bones can be bent backwards "and forwards, they cannot be pulled from each other "the tenth part of an inch." Theſe inquiries were made by one, who, though partial to the other ſide of this queſtion, could not allow himſelf to diſguiſe the truth, whoſe authority is the higheſt, and by whoſe facts I ſhould moſt willingly abide.

Now, it is plain, that ſince a ſeparation, amounting only to the 12th of an inch, occaſions death, this cannot be a proviſion of nature; and ſince the ſeparation in ſuch degree could not enlarge the openings of the baſin, there again it cannot be a proviſion of nature. I know that tales are not awanting of women whoſe bones were ſeparated during labour; but what is there ſo abſurd, that we ſhall not find a precedent or parallel caſe in our annals of monſtrous and incredible facts? Or rather, where is there a fact of this deſcription which is not balanced and oppoſed by oppoſite authorities and facts? I have diſſected ſeveral women who had died in lingering labour, where I found no diſunion of the bones. I have ſeen women opened, after the greateſt violence with inſtruments, and yet found no ſeparation of the bones. We have caſes of women having the mollities oſſium, a univerſal ſoftneſs and bending of the bones, who have lived in this condition for many years, with the pelvis alſo affected; its openings gradually more and more abridged; the miſerable woman ſuffering lingering labour, and undergoing the delivery by hooks, with all the violence that muſt be uſed in ſuch deſperate caſes, and ſtill no ſeparation of the bones happening. How, indeed, ſhould there be ſuch difficult labours as theſe, if the ſeparation of the bones could allow the child to paſs?

If it be ſaid, "the joinings of the pelvis are ſometimes diſſolved," I acknowledge, that they are, juſt as the joint of the thigh is diſſolved; that is, ſometimes by violence, and ſometimes by internal diſeaſe; but if it be affirmed, that " the joinings of the pelvis are " diſſolved to facilitate labour," I would obſerve, that wherever ſeparation of the bones has happened, it has both increaſed the difficulties of the labour, and been in itſelf a very terrible diſeaſe; for proofs of which, I muſt refer to Hunter, Denman, and others, to whoſe peculiar province ſuch caſes belong. But ſurely theſe principles will be univerſally acknowledged: That the pelvis ſupporting the trunk is the centre of its largeſt motions: that if the bones of the pelvis were looſened, ſuch motions could no longer be performed: that when, by violence or by internal diſeaſe, or in the time of ſevere labour, theſe joinings have actually been diſſolved or burſt, the woman has become inſtantly lame, unable to ſit, ſtand, or lie, or ſupport herſelf in any degree; ſhe is rendered incapable of turning, or even of being turned in bed; her attendants cannot even move her legs without intolerable anguiſh, as if torn aſunder *. There ſometimes follows a collection of matter within the joint (the matter extending quite down to the tuber iſchii), high fever, delirium, and death †; or, in caſe of recovery (which is indeed more frequent), the recovery is ſlow and partial only; a degree of lameneſs remains, with pain, weakneſs, and languid health; they can ſtand on one leg more eaſily than on both; they can walk more eaſily than they can ſtand; but it is many months before they can walk without crutches; and long after they come to walk upon even ground, climb-

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* Denman.

† Hunter.

climbing a ſtair continues to be very difficult and painful. In order to obtain even this ſlow re-union of the bones, the pelvis muſt be bound up with a circular bandage very tight; and they muſt ſubmit to be confined long: by neglect of which precautions, ſometimes, by the rubbing of the bones, a preternatural joint is formed, and they continue lame for years, or for life *; or ſometimes the bones are united by oſſification; the callus or new bone projects towards the centre of the pelvis, and makes it impoſſible for the woman to be delivered again of a living child †.

Now this hiſtory of the diſeaſe leads to reaſons independent of anatomy, and ſurer than it; which prove, that this ſeparation of the bones (an accident the exiſtence of which cannot be queſtioned) is not a proviſion of nature, but a moſt ſerious diſeaſe. For if theſe be the dreadful conſequences of ſeparation of the bones, how can we believe that it happens, when we ſee women walking during all their labour, and, in place of being pained, rather relieved by a variety of poſtures, and by walking about their room? when we ſee them often walk to bed after being delivered on chairs or couches? riſe up on the third day; and often reſume the care and fatigues of a family in a few days more? or can we believe, that there is a tendency to ſeparation of the bones in thoſe who, following the camp, are delivered on one day, and walk on the following? or in thoſe women who, to conceal their

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* Denman ſays twenty-five or thirty years.

† Spence's caſes.

their ſhame, have not indulged in bed a ſingle hour? or can we believe, that there is even the ſlighteſt tendency to the ſeparation of the bones in thoſe women whoſe pelvis reſiſts the force of a lingering and ſevere labour; who ſuffer ſtill further all the violence of inſtruments; who yet recover as from a natural delivery, and who alſo riſe from bed on the third or fourth day?

CHAP. VI.

BONES OF THE THIGH, LEG, AND FOOT.

THE THIGH-BONE is the greateſt bone of the body, and needs to be ſo, ſupporting alone, and in the moſt unfavourable direction, the whole weight of the trunk; for though the body of this bone is in a line with the trunk, in the axis of the body, its neck ſtands off almoſt at right angles with the body of the bone; and in this unfavourable direction muſt it carry the whole weight of the trunk; for the body is ſeldom ſo placed as to reſt its weight equally upon either thigh-bone; commonly it is ſo inclined from ſide to ſide alternately, that the neck of one thigh-bone bears alone the whole weight of the body and limbs, or is ſtill loaded with greater burdens than the mere weight of the body itſelf.

The thigh-bone is one of the moſt regular of the cylindrical bones. 1. Its BODY is very thick and ſtrong; of a rounded form; ſwelling out at either end into two heads. In its middle it bends a little outwards, with its circle or convex ſide turned towards the fore part of the thigh. This bending of the thigh-bone has been a ſubject of ſpeculation abundantly ridiculous, viz. whether this be an accidental or a natural arch. There are authors who have aſcribed it to the nurſe carrying the child by the thighs, and its ſoft bones bending under the weight. There is another author, very juſtly celebrated, who imputes it to the weight of the body and the ſtronger action of the flexor muſcles; affirming, that it is ſtraight in the child, and grows convex by age. This could not be, elſe we ſhould find this curve leſs in ſome, and greateſt in thoſe who had walked moſt, or whoſe muſcles had the greateſt ſtrength; and if the muſcles did produce this curve, a little accident giving the balance to the flexor muſcles ſhould put the thigh-bone in their power to bend it in any degree, and to cauſe diſtortion. But the end of all ſuch ſpeculations is this, that we find it bended in the fœtus not yet delivered from the mother's womb, or in a chicken while ſtill encloſed in the ſhell; it is a uniform and regular bending, deſigned and [illegible] marked in the very firſt formation of the bone, and intended, perhaps, for the advantage of the ſtrong muſcles in the back of the thigh, to give them greater power, or more room.

2. The HEAD of the thigh-bone is likewiſe the moſt perfect of any in the human body; for its circumference is a very regular circle, of which the head contains nearly two-thirds: It is ſmall, neat, and completely received into its ſocket, which is not only deep in itſelf, and very ſecure, but is further deepened by the cartilage which borders it; ſo that this is naturally, and without the help of ligaments, the ſtrongeſt joint in all the body; but among other ſecurities which are ſuperadded, is the round ligament, the mark of which is eaſily ſeen, being a broad dimple in the centre of its head.

3. The NECK of this bone is the trueſt in the ſkeleton; and indeed it is from this neck of the thigh-bone that we transfer the name to other bones, which have hardly any other mark of neck than that which is made by their purſe-like ligament being fixed behind the head of the bone, and leaving a roughneſs there. But the neck of the thigh-bone is an inch and a half in length, thick and ſtrong, yet hardly proportioned to the great weights which it has to bear; long, that it may allow the head to be ſet deeper in its ſocket; and ſtanding wide up from the ſhoulder of the bone, to keep its motions wide and free, and unembarraſſed by the pelvis; for without this great length of the neck, its motions had been checked even by the edges of its own ſocket.

The TROCHANTER are the longeſt proceſſes in the human body for the attachment of muſcles, and they are named trochanter (or proceſſes for turning the thigh) from their office, which is the receiving of thoſe great muſcles which not only bend and extend the thigh but turn it upon its axis; for theſe proceſſes are oblique, ſo as to bend and to turn the thigh at once.

4. The TROCHANTER MAJOR, the outermoſt and longer of the two, is that great bump which repreſents the direct end of the thigh-bone, while the neck ſtands off from it at one ſide; therefore the great trochanter ſtands above the neck, and is eaſily diſtinguiſhed outwardly, being that great bump which we feel ſo plainly in laying the hand upon the haunch. This proceſs receives the glutæi muſcles, and all the great muſcles which move the thigh outwards.

5. The TROCHANTER MINOR, or leſſer trochanter, is ſmaller and more pointed; riſing on the inner ſide of the bone; lower than the trochanter major, and placed under the root of the neck, as the greater one is placed above it. It is deeper in the thigh, and never to be felt, not even in luxations. Its muſcles alſo, by the obliquity of their inſertion into it, turn the thigh, and bend it towards the body; ſuch as the pſoas and iliacus internus, which paſſing out from the pelvis, ſink deep into the groin, and are implanted into this point. From the one trochanter to the other, there is a very conſpicuous roughneſs, which marks the place of the capſule, or ligamentary bag of the joint; for it encloſes the whole length of the neck and of the thigh-bone. This

roughneſs begins the great rough line, and is what is regularly named the linea aſpera.

6. The LINEA ASPERA is a riſing or prominent line, very ragged and unequal, which runs all down the back part of the thigh: It begins at the roots of the two trochanters, and the rough lines from each trochanter meet about four inches down the bone; thence the linea aſpera runs down the back of the bone a ſingle line, and forks again into two lines, one going towards each condyle, and ending in the tubercles at the lower end of the bone; ſo that the linea aſpera is ſingle in the middle, and forked at either end.

7. The CONDYLES are the two tubers into which the thigh-bone ſwells out at its lower part. There is firſt a gentle and gradual ſwelling of the bone; then an enlargement into two broad and flat ſurfaces, which are to unite with the next bone in forming the great joint of the knee. The two tuberoſities, which, by their flat faces, form the joint, ſwell out above the joint, and are called the CONDYLES. The INNER CONDYLE is larger, to compenſate for the oblique poſition of the thigh-bone; for the bones are ſeparated at their heads by the whole width of the pelvis, but are drawn towards a point below, ſo as to touch each other at the knees. On the fore part of the bone, betwixt the condyles, there is a broad ſmooth ſurface, upon which the rotula, or pulley-like bone glides; and on the back part of the thigh-bone, in the middle betwixt the condyles, there is a deep notch, which contains the great artery, vein, and nerve of the leg.

The great nutritious artery enters below the middle of this bone, and ſmaller arteries enter through its porous extremities; as may be known by many ſmall holes near the head of the bone.

The HEAD of the thigh-bone is round, and ſet down deeply in its ſocket, to give greater ſecurity to a joint ſo important, and ſo much expoſed as the hip is. The NECK ſtands off from the reſt of the bone, ſo that by its length, it allows a free play to the joint, but is itſelf much expoſed by its tranſverſe poſition, as if nature had not formed in the human body any joint at once free, moving and ſtrong. The neck is not formed in the boy, becauſe the ſocket is not yet deep, nor ſuch as to hinder the motions of the thigh; and the head is formed apart from the bone, and is not firmly united with it till adult years, ſo that falls luxate or ſeparate the head in young people, but they break the neck of the bone in thoſe that are advanced in years. The TROCHANTERS, or ſhoulders, are large to receive the great muſcles which are implanted in them, and oblique, that they may at once bend and turn the thigh. The SHAFT or BODY is very ſtrong, that it may bear our whole weight, and the action of ſuch powerful muſcles; and it is marked with the rough line, behind from which a maſs of fleſh takes its riſe, which wraps completely round the lower part of the thigh-bone, and forms what are called the vaſti muſcles, the greateſt muſcles for extending the leg. The CONDYLES ſwell out to give a broad ſurface, and a firm joining for the knee. But of all its parts, the great trochanter ſhould be moſt particularly obſerved, as it is the chief mark in luxations or fractures of this bone: For when the greater trochanter is puſhed downwards, we find the thigh luxated downwards;

when the trochanter is higher than its true place, and ſo fixed that it cannot roll, we are aſſured that it is luxated upwards; but when the trochanter is higher than its true place, with the thigh rolling freely, we are aſſured its neck is broken, the trochanter being diſplaced, and the broken head remaining in its ſocket; but when the trochanter remains in its place, we ſhould conclude that the joint is but little injured, or that it is only a bruiſe of thoſe glands or mucous follicles which are lodged within the ſocket for lubricating the joint.

The TIBIA is named from its reſemblance to a pipe; the upper part of the tibia, repreſenting the expanded or trumpet-like end, the lower part repreſenting the flute end of the pipe. The tibia, on its upper end, is flat and bread, making a moſt ſingular articulation with the thigh-bone; for it is not a ball and ſocket like the ſhoulder or hip, nor a hinge joint guarded on either ſide with projecting points like the ankle. There is no ſecurity for the knee joint by the form of its bones, for they have plain flat heads: they are broad indeed, but they are merely laid upon each other. It is only by its ligaments that this joint is ſtrong; and by the number of its ligaments it is a complex and delicate joint peculiarly liable to diſeaſe.

1. The UPPER HEAD of the tibia is thick and ſpongy, and we find there two broad and ſuperficial hollows, as if impreſſed while ſoft, with the marks of the condyles of the thigh-bone; and theſe ſlight hollows are all the cavity that it has for receiving the thigh-bone. A pretty high ridge riſes betwixt theſe two

hollows, ſo as to be received into the interſtice betwixt the condyles; and at the back part, which is the higheſt point of the ridge, an internal ligament ties the tibia to the thigh-bone. This ſpongy head has alſo a rough margin, to which the capſular ligament is tied; on the fore part of this bone, juſt below the knee, there is a bump for receiving the great ligament of the patella, or, in other words, the great tendon of all the extenſor muſcles of the leg; and laſtly, there is upon the outer ſide of this ſpongy head, juſt under the margin of the joint, a ſmooth articulating ſurface, (like a dimple impreſſed with the finger), for receiving the head of the fibula. It is under the margin of the joint, for the fibula does not enter at all into the knee joint; it is only laid upon the ſide of the tibia, fixed to it by ligaments, but not received into any thing like a cavity.

2. The BODY of the bone is of a priſmatic or triangular form, and its three edges or acute angles are very high lines running along its whole length; one line a little waved, and turned directly forwards, is what is called the ſhin. At the top of this ridge is that bump into which the ligament of the rotula or patella is implanted; and the whole length of this acute line is ſo eaſily traced through the ſkin, that we can never be miſtaken about fractures of this bone. Another line leſs acute than this is turned directly backwards; and the third acute line, which completes the triangular form, is turned towards the fibula, to receive a broad ligament, or interoſſeous membrane, which ties the two bones together.

3. The lower head of the tibia compoſes the chief parts of the ankle-joint. The lower head of the tibia

is ſmaller than the upper, in the ſame proportion that the ankle is ſmaller than the knee. The pointed part of this head of the tibia repreſents the mouth piece, or flute part of the pipe, and conſtitutes the bump of the INNER ANKLE. The lower end of the fibula lies ſo upon the lower end of the tibia, as to form the outer ankle; and there is on the ſide of the tibia a deep hollow, like an impreſſion made with the point of the thumb, which receives the lower end of the fibula. The acute point of the tibia, named the proceſs of the inner ankle, paſſes beyond the bone of the foot, and, by lying upon the ſide of the joint, guards the ankle, ſo that it cannot be luxated inwards, without this pointed proceſs of the maleolus internus, or inner ankle, being broken.

The tibia is a bone of great ſize, and needs to be ſo, for it ſupports the whole weight of the body. It is not at all aſſiſted by the fibula in bearing the weight, the fibula, or ſlender bone, being merely laid upon the ſide of the tibia, for uſes which ſhall be explained preſently. The tibia is thick, with much cancelli or ſpongy ſubſtance within; has pretty firm plates without; is much ſtrengthened by its ridges, and by its triangular form: its ridges are regular with regard to each other, but the whole bone is twiſted as if it had been turned betwixt the hands when ſoft: This diſtortion makes the proceſs of the inner ankle lie not regularly upon the ſide of that joint, but a little obliquely forwards, determining the obliquity of the foot; which muſt be of much conſequence, ſince there are many proviſions for ſecuring this turning of the foot, viz. the oblique poſition of the trochanters; the oblique inſertion of all the muſcles, and this obliquity of the ankles; the inner ankle advancing a little before the joint, and the outer ankle receding in the ſame degree behind it.

The FIBULA, which is named ſo from its reſemblance to the Romam claſp, is a long ſlender bone, which is uſeful partly in ſtrengthening the leg, but chiefly in forming the ankle joint; for the tibia only is connected with the knee, while the fibula, which has no place in the knee joint, goes down below the lower end of the tibia, forming the long proceſs of the outer ankle.

The fibula is a long and ſlender bone, the longeſt and ſlendereſt in the body. It lies by the ſide of the tibia like a ſplint; ſo that when at any time the tibia is broken without the fibula, or when the tibia having ſpoiled, becomes carious, and a piece of it is loſt, the fibula maintains the form of the limb till the laſt piece be replaced, or till the fracture be firmly reunited. It is, like the tibia, triangular, and has two heads, which are knots, very large, and diſproportioned to ſo ſlender a bone. The ſharpeſt line of the fibula is turned to one ſharp line of the tibia, and the interoſſeous membrane paſſes bewixt them. The bone lies in a line with the tibia, on the outer ſide of it, and a little behind it. The upper head of the fibula is laid upon a plain ſmooth ſurface, on the ſide of the tibia, a little below the knee; and though the fibula is not received deep into the tibia, this want is compenſated for by the ſtrong ligaments by which this little joint is tied by the knee, being completely wrapped round with the expanded tendons of thoſe great muſcles which make up the thigh, by the knee being ſtill farther embraced cloſely by the faſcia, or tendinous expanſion of the thigh; but above all, by the tendons of the outer hamſtrings being fixed into this knot of the fibula, and expanding from that over the fore part of the tibia.

The lower head of the fibula is let pretty deep into a ſocket on the ſide of the tibia; together, they form the ankle joint for receiving the bones of the foot. The ankle joint is one of the pureſt hinge joints, and is very ſecure; for there is the tibia, at the proceſs of the inner ankle, guarding the joint within; there is the fibula paſſing the joint ſtill further, and making the outer ankle ſtill a ſtronger guard without. Theſe two points, projecting ſo as to encloſe the bones of the foot, make a pure hinge; prevent all lateral motion; make the joint firm and ſtrong; and will not allow of luxations till one or both ankles be broken. We know that there is little motion betwixt the tibia and fibula; none that is ſenſible outwardly, and no more in truth than juſt to give a ſort of elaſticity, yielding to ſlighter ſtrains. But we are well aſſured, that this motion, though ſlighteſt and imperceptible, is very conſtant; for theſe jointing of the fibula with the tibia are always found ſmooth and lubricated; and there are no two bones in the body ſo cloſely connected as the tibia and fibula are, which are ſo ſeldom anchyloſed, *i. e.* joined into one by diſeaſe.

The fibula may be thus defined: It is a long ſlender bone, which anſwers to the double bone of the fore arm, completes the form, and adds ſomewhat to the ſtrength of the leg; it gives a broader origin for its ſtrong muſcles; lies by the ſide of the tibia like a ſplint; and, being a little arched towards the tibia, ſupports it againſt thoſe accidents which would break it acroſs, and maintains the form of the leg when the tibia is carious or broken; the fibula, though it has little connection with the knee, paſſes beyond the ankle joint, and is its chief guard and ſtrength in that direction in which the joint ſhould be moſt apt to yield; and in this office of guarding the ankle, it is ſo true, that the ankle cannot yield till this guard of the fibula be broken.

Rotula or patella, or knee-pan, is a ſmall thick bone, of an oval, or rather triangular form. The baſis of this rounded triangle is turned upwards to receive the four great muſcles which extend the leg; the pointed part of this triangle is turned downwards, and is tied by a very ſtrong ligament to the bump or tubercle of the tibia, juſt under the knee. This ligament is called the ligament of the patella, or of the tibia, connecting the patella ſo cloſely, that ſome anatomiſts of the firſt name chooſe to ſpeak of the patella as a mere proceſs of the tibia, (as the olecranon is a proceſs of the ulna), only flexible and looſe; an arrangement which I think ſo far right and uſeful, as the fractures of the olecranon and of the patella are ſo much alike, eſpecially in the method of cure, that they may be ſpoken of as one caſe; for theſe two are the only exceptions to the common rules and methods of ſetting broken hones.

The patella is manifeſtly uſeful, chiefly as a lever; for it is a pulley, which is a ſpecies of lever, gliding upon the fore part of the thigh-bone upon the ſmooth ſurface which is betwixt the condyles. The projection of this bone upon the knee removes the acting force from the centre of motion, ſo as to increaſe the power; and it is beautifully contrived, that while the knee is bent, and the muſcles at reſt, as in ſitting, the patella ſinks down concealed into a hollow of the knee. When the muſcles begin to act, the patella begins to riſe from this hollow; in proportion as they contract, they loſe of their ſtrength, but the patella gradually riſing, increaſes the power; and when the contraction is nearly perfect, the patella has riſen to the ſummit of the knee, ſo that the riſing of the patella raiſes the mechanical power of the joint in exact proportion as the contraction expends the living contractible power of the muſcles. What is curious beyond almoſt any other fact concerning the fractures of bones, the patella is ſeldom broken by a fall or blow; in nine of ten caſes, it is rather torn, if we may uſe the expreſſion, by the force of its own muſcles, while it ſtands upon the top of the knee, ſo as to reſt upon one ſingle point; for while the knee is half bended, and the patella in this dangerous ſituation, the leg fixed, and the muſcles contracting ſtrongly to ſupport the weight of the body, or to raiſe it as in mounting the ſteps of a ſtair, the force of the muſcles is equivalent at leaſt to the weight of the man's body; and often, by a ſudden violent exertion, their power is ſo much increaſed, that they ſnap the patella acroſs, as we would break a ſtick acroſs the knee.

The TARSUS, or INSTEP, is compoſed of ſeven large bones, which form a firm and elaſtic arch for ſupporting the body; which arch has its ſtrength from the ſtrong ligaments with which theſe bones are joined, and its elaſticity from the ſmall movements of theſe bones with each other; for each bone and each joint has its cartilage, its capſule or bag, its lubricating fluid, and all the apparatus of a regular joint; each moves, ſince the cartilages are always lubricated, and the bones are never joined by anchyloſis with each other; but the effect is rather a diffuſed elaſticity, than a marked and perceptible motion in any one joint.

The ſeven bones of which the tarſus is compoſed are, 1. The ASTRAGALUS, which, united with the tibia and fibula, forms the ankle joint: 2. The os CALCIS, or heal bone, which forms the end or back point of that arch upon which the body ſtands: 3. The os NAVICULARE, or boat-like bone, which joins three ſmaller bones of the fore part of the tarſus to the aſtragalus: 4. The os CUBOIDES, which joins the ſmaller bones of the fore part to the os calcis: The 5th, 6th, and 7th, are the ſmaller bones making the fore part of the tarſus; they lie immediately under the place of the ſhoe-buckle, and are named the three CUNEIFORM BONES, from their wedge-like ſhape; and it is upon theſe that the metatarſal bones, forming the next diviſion of the foot, are implanted.

Theſe bones of the tarſus form, along with the next rank, or metatarſal bones, a double arch; firſt from the loweſt point of the heal to the ball of the great toe, is one arch; the arch of the ſole of the foot which ſupports the body: and again, there is another arch within this, formed among the tarſal bones themſelves, one within another, *i. e.* betwixt the aſtragalus, calcis, and naviculare; through which hole, in my drawing, there is paſſed a pencil. It is this ſecond arch which gives a perfect elaſticity to the foot, and muſt prevent the bad effects of leaping, falls, and other ſhocks, which would have broken a part leſs curiouſly adapted to its office.

1. The ASTRAGALUS is the greateſt and moſt remarkable bone of the tarſus; and which the ſurgeon is moſt concerned in knowing. The ſemicircular head of this bone forms a curious and perfect pulley. The circle of this pulley is large; its cartilage is ſmooth and lubricated; it is received deep betwixt the tibia and fibula; and rolls under the ſmooth articular ſurface of the latter, which being ſuited to this pulley of the aſtragalus, with ſomething of a boat-like ſhape, is often named the ſcaphoid cavity of the tibia. 1. We remark in the aſtragalus its articulating ſurface, which is arched, high, ſmooth, covered with cartilage, lubricated, and in all reſpects a complete joint. Its form is that of a pulley, which, of courſe, admits of but one direct motion, viz. forwards and backwards. 2. We obſerve its ſides, which are plain, ſmooth, and flat, covered with the ſame cartilage, forming a part of the joint, and cloſely locked in by the inner and outer ankles, ſo as to prevent luxations or awkward motions to either ſide. 3. We obſerve two large irregular articulating ſurfaces backwards, by which is is joined to the os calcis. 4. There is on the fore part, or rather the fore end of the aſtragalus, a large round head, as regular as the head of the ſhoulder bone, by which it is articulated with the ſcaphoid bone.

2. The os CALCIS is the large irregular bone of the

heel; it is the tip or end of the arch formed by the tarſal and metatarſal bones. There is a large ſcabrous point on which we ſtand; which is rough, for the inſertion of the great Achillis tendon, the rope by which the muſcles of the bran act. The roughneſs of the heel-bone gives the tendon a firm hold, and its projection backwards gives it the power of a very long lever. The points to be obſerved are, 1. The great backward projection, which is properly called the heel; ſcabrous and rough, for the inſertion of the great back tendon; the point upon which we walk and ſtand. 2. An irregular articular ſurface, or rather two ſurfaces covered with cartilage, by which it is joined with the aſtragalus. 3. Another articulating ſurface by which it is joined with the os cuboides. And, 4. A ſort of arch downwards, under which the veſſels and nerves and the tendons alſo paſs on ſafely into the ſole of the foot.

5. NAVICULARE is named OS NAVICULARE, or OS SCAPHOIDES, from a fanciful reſemblance to a boat. But this is a name of which anatomiſts have been peculiarly fond, and which they have uſed with very little diſcretion or reſerve: the ſtudent will hardly find any ſuch reſemblance: it is rather like the dies with which we play at drafts; that is, a flattened circular body, with its borders riſing up a little; and each flat ſide forms an articulating ſurface. That concave ſide which looks backwards, is pretty deep, and receives the head of the aſtragalus: that flat ſide which looks forwards, has not ſo deep a ſocket, but receives the three cuneiform bones upon a ſurface rather plain and irregular

The CUNEIFORM BONES are ſo named, becauſe they reſemble wedges, being laid to each other like the ſtones of an arch. The moſt ſimple and proper arrangement is, 1. 2. and 3.; counting from the ſide of the great toe towards the middle of the foot; but they are commonly named thus: The firſt cuneiform bone, on which the great toe ſtands, has its cutting edge turned upwards; it is much larger than the others, and ſo is called OS CUNEIFORME MAGNUM. The ſecond cuneiform bone, or that which ſtands the middle of the three cuneiform bones, is much ſmaller, and is therefore named OS CUNEIFORME MINIMUM. The third in order of the cuneiform bones is named OS CUNEIFORME MEDIUM *. Theſe cuneiform bones receive the great toe, and the two next to it. The fourth and fifth toes are implanted upon the laſt bone in the row, the os cuboides,

OS CUBOIDES.—The os cuboides is named from its cubical figure; and is next to the aſtragalus in ſize; greater than the ſcaphoid bone. The three cuneiform bones are laid regularly by the ſide of each other; and this os cuboides is again laid on the outer ſide of the third cuneiform bone, and joins it to the os calcis. The place and effect of the cuboid bone is

very

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* The confuſion in theſe names ariſes from ſometimes counting them by their place, and ſometimes reckoning according to their ſize. It is only in relation to its ſize that we call one of theſe bones os cuneiforme medium; for the os cuneiforme medium is not in the middle of the three; it is the middle bone with reſpect to ſize: it is the ſmalleſt of the cuneiform bones that ſtands in the middle betwixt the other two.

very curious; for as it is wedged in betwixt the third cuneiform bone and the os calcis, it forms a complete arch within an arch, which gives at once a degree of elaſticity and of ſtrength which no human contrivance could have equalled. There is firſt a great arch on which the body reſts, and the heel and the great toe are the horns of that bow: And, ſecondly, there is a complete circle among the metatarſal bones, leaving an opening betwixt the aſtragalus and the os calcis.

THE TOES.—The laſt diviſion of the foot conſiſts of three diſtinct bones; and as theſe bones are diſpoſed in rows, they are named the firſt, ſecond, and third phalanges or ranks of the toes.

The great toe has but two phalanges; the other toes have three ranks of bones, which have nothing particular, only the joints are round and free; formed by a round head on one bone, and by a pretty deep hollow, for receiving it, in the one above it; they are a little flattened on their lower ſide, or rather they have a flattened groove which lodges the tendons of the laſt joint of the toes.

The SESAMOID BONES are more regularly found about the toes than any where elſe. They are ſmall bones, like peaſe, found in the hearts of tendons, at any point where they ſuffer much friction; or rather they are like the ſeeds of the ſeſamum, whence their name. They are found chiefly at the roots of the great toe, and of the thumb; at each of theſe places we find two ſmall ſeſamoid bones, one on each ſide of the ball of the great toe, and one on each ſide of the ball of the thumb; but theſe bones do not enter into the joint; they are within in the ſubſtance of the tendons; perhaps, like the patella, they remove the acting force from the centre of motion; and ſo, by acting like pulleys, increaſe the power; perhaps alſo by lying at the ſides of the joint in the tendons of the ſhorter muſcles of the toes, they make a ſafe gutter for the long tendons to paſs in. They are not reſtricted to the balls of the great toe and thumb, but ſometimes are alſo found under the other toes and fingers, and ſometimes behind the condyles of the knee; or in the peronæi tendons, which run under the ſole of the foot. In ſhort, they are ſo far from being regular bones, that they are found only in adults, and are ſo often found in irregular places, that they almoſt ſeem to be produced by chance, or by the effect of friction.

METATARSUS.—The metatarſus, ſo named from its being placed upon the tarſus, conſiſts of five bones, which differ ſo little from the firſt bones of the fingers, that they need not be minutely demonſtrated. It is ſufficient to mark, that they are five in number, having a general reſemblance to the joints of the finger; that they are rather flattened, eſpecially on their lower ſides, where the tendons of the toes lie; that they are very large at their ends next the tarſus, where they have broad flat heads, that they may be implanted with great ſecurity; that they grow ſmaller towards the toes, where again they terminate, in neat ſmall round heads, which receive the firſt bones of the toes, and permit of a very free and eaſy motion, and a greater degree of rotation than our dreſs allows us to avail ourſelves of; the toes being cramped together, in a degree that fixes them all in their places, huddles one above another, and is quite the reverſe of that free and ſtrong-like ſpreading of the toes, which the painter always repreſents. Laſtly, it ſhould be remarked, that the metatarſal bone of the little toe makes a ſalient anlge, projecting over the tarſus, in a point which is eaſily felt outwardly, at the place where the ſide ſeam of the ſhoe croſſes: for this and all the other marks of the metatarſal bones are chiefly uſeful, as directing us where to cut in amputating theſe bones; and the ſurgeon will ſave the patient much pain, and himſelf the ſhame of a ſlow and confuſed operation, by marking the places of the joints.

CHAP. VII.

BONES OF THE SHOULDER, ARM, AND HAND.

OF THE SCAPULA, OR SHOULDER-BLADE.

This is the great peculiarity of the ſuperior extremity, that it is connected not directly with the trunk, like the thigh-bone with the haunch, but is hung by a moveable intermediate bone; which not only is not immediately joined to the trunk by ligaments, or any other form of connection, but is parted from it by ſeveral layers of muſcular fleſh, ſo that it lies flat, and glides upon the trunk.

The SCAPULA is a thin bone; which has originally, like the ſkull, two tables, and an intermediate diploë; but by preſſure, and the action of its own muſcles, it grows gradually thinner; its tables are more and more condenſed; till in old age it has become perfectly tranſparent, and is ſupported only by its proceſſes, and by its thicker edges. For its SPINE is a ridge of firm and ſtrong bone, which riſes very high, and gives a broad origin and ſupport for its muſcles: The ACROMION in which the ſpine terminates, is a broad and flat proceſs, a ſure guard for the joint of the ſhoulder: The CORACOID proceſs is a ſtrong but ſhorter proceſs, which ſtands out from the neck of the bone; and the COSTA, or borders of the bone are alſo rounded, firm, and ſtrong: So that the proceſſes and borders ſupport the flat part of the bone, which is as thin as a ſheet of paper, and quite tranſparent.

There is no part nor proceſs of the ſcapula which does not require to be very carefully marked; for no accidents are more frequent than luxations of the ſhoulder; and the various luxations are explained beſt by ſtudying in the ſkeleton, and being able to recognize on the living body all the proceſſes and projecting points.

1. The FLAT SIDE of the ſcapula is ſmooth, ſomewhat concave, and ſuited to the convexity of the ribs. The ſcapula is connected with no bone of the trunk; tied by no ligaments; is merely laid upon the cheſt, with a large maſs of muſcular fleſh under it, upon which it glides; for there are below it two layers of muſcles,

by one of which the ſhoulder bone is moved upon the ſcapula, while by the other the ſcapula itſelf is moved upon the ribs. The muſcle lying in the hollow of the ſcapula marks it with many ſmooth hollows and wave-like riſings, which are merely the marks of the origin of its muſcles, but which were miſtaken even by the great Veſalius for the impreſſions of the ribs.

2. The outer flat ſurface is like the inner one, but that it is traverſed by the SPINE, which is a very acute and high ridge of bone. Now the ſpine, thus traverſing the bone from behind forwards, divides its outer ſurface into two unequal parts, of which the part above the ſpine is ſmaller, and that below the ſpine is larger. Each of theſe ſpaces has its name, one ſupra ſpinatus, and the other infra ſpinatus; and each of them lodges a muſcle, named, the one the muſculus ſupra-ſpinatus ſcapulæ, as being above the ſpine; the other, muſculus infra-ſpinatus ſcapulæ, as being below the ſpine. A third muſcle is named ſubſcapularis, as lying under the ſhoulder blade, upon that concave ſurface which is towards the ribs; ſo that the whole ſcapula is covered with broad flat muſcles, whoſe offices are to move the ſhoulder bone in various directions, and which impreſs the ſcapula with gentle riſings and hollows on its outer as well as on its inner ſurface.

3. The TRIANGULAR form of the ſcapula muſt be next obſerved. The upper line of the triangle is the ſhorteſt; it is named the COSTA or border. This ſuperior coſta of the ſcapula receives thoſe ſtrong and flat muſcles that raiſe the ſhoulder upwards. The lower border, which is named the COSTA INFERIOR, or the

lower border of the ſcapula, receives no muſcles, becauſe it muſt be quite free, to move and glide as the ſcapula turns upon its axis, which is indeed its ordinary movement. But it gives riſe to two ſmaller muſcles, which, from being a little rounded, are named the muſculi teres; which round muſcles being implanted into the arm bone, pull it downwards.

The long ſide of the ſcapula, which bounds its triangular form backwards, is named the BASIS of the SCAPULA, as it repreſents the baſe of the triangle. This line is alſo, like the two borders, a little thicker, or ſwelled out; and this edge receives many powerful muſcles, which lie flat upon the back, and coming to the ſcapula in a variety of directions, can turn it upon its axis, ſometimes raiſing ſometimes depreſſing the ſcapula; ſometimes drawing it backwards; and ſometimes fixing it in its place, according to the various ſets of fibres which are put into action.

4. The GLENOID, or ARTICULATING CAVITY of the ſcapula, is on the point or apex of this triangle. The ſcapula is more ſtrictly triangular in a child, for it terminates almoſt in a point or apex; and this articulating ſurface is a ſeparate oſſification, and is joined to it in the adult. The ſcapula towards this point terminates in a flat ſurface, not more than an inch in diameter, very little hollowed, and ſcarcely receiving the head of the ſhoulder-bone, which is rather laid upon it than ſunk into it: It is indeed deepened a little by a circular griſtle, which tips the edges or lips of this articulating ſurface, but ſo little, that it is ſtill very ſhallow and plain, and luxations of the ſhoulder are infinitely more frequent than of any other bone.

5. This head, or glenoid cavity of the ſcapula, is planted upon a narrower part, which tends towards a point, but is finiſhed by this flat head; this narrower part is what is named the NECK of the SCAPULA, which no doubt ſometimes gives way, and breaks. A rough line bordering the glenoid cavity receives the capſular ligament, or rather the capſule ariſes from that bordering griſtle, which I have ſaid tips the circle.

6. The SPINE of the SCAPULA is that high ridge of bone, which runs the whole length of its upper ſurface, and divides it into two ſpaces for the origin of the ſupra and infra ſpinatus muſcles. It is high, and very ſharp, ſtanding up at one place to the height of two inches. It is flattened upon the top, and with edges, which turning a little towards either ſide, give riſe to two ſtrong faſciæ, *i. e.* tendinous membranes; which go from the ſpine, the one upwards to the upper border of the ſcapula, the other downwards to the lower border; ſo that by theſe ſtrong membranes the ſcapula is formed into two triangular cavities, and the ſupra and infra ſpinatus muſcles riſe not only from the back of the ſcapula, and from the ſides of its ſpine, but alſo from the inner ſurface of this tenſe membrane. The ſpine traverſes the whoſe dorſum, or back of the ſcapula; it receives the trapezius muſcle, that beautiful triangular muſcle which covers the neck like a tippet, whence it has its name; and the ſpine beginning low at the baſis of the ſcapula, gradually riſes as it advances forwards, till it terminates in that high point or promontory which forms the tip of the ſhoulder, and overhangs and defends the joint.

7. This high point is named the ACROMION PROCESS. It is the continuation and ending of the ſpine, which at firſt riſes perpendicularly from the bone, but by a ſort of turn or diſtortion it lays its flat ſide towards the head of the ſhoulder-bone. At this place, it is thickened, flat and ſtrong; overhangs and defends the joint; and is not merely a defence, but almoſt makes a part of the joint itſelf; for without this proceſs, the ſhoulder-bone could not remain a moment in its ſocket; every ſlight accident would diſplace it. The acromion prevents luxation upwards, and is ſo far a part of the joint, that when it is full under the acromion, the joint is ſafe; but when we feel a hollow, ſo that we can puſh the points of the fingers under the acromion proceſs, the ſhoulder is luxated, and the ſocket empty. The point of the acromion, forming the apex of the ſhoulder, a greater projection of this point, and a fulneſs of the deltoid muſcle which ariſes from it, is a chief cauſe, and of courſe a chief mark, of ſuperior ſtrength.

8. But there is ſtill another ſecurity for the joint; for there ariſes from the neck of the ſcapula, almoſt from the border of the ſocket, and its inner ſide, a thick, ſhort, and crooked proceſs, which ſtands directly forwards, and is very conſpicuous; and which, turning forwards with a crooked and ſharp point, ſomewhat like the beak of a crow, is thence named the CORACOID PROCESS. This alſo guards and ſtrengthens the joint; though it cannot altogether prevent luxations, it makes them leſs frequent; and moſt probably when the arm is luxated inwards, it is by ſtarting over

the point of this defending proceſs. A muſcle, named coracoid, comes down from the joint of this proceſs, and is inſerted into the middle of the ſhoulder-bone, to draw the arm towards the ſide.

Now the glenoid ſurface, and theſe two proceſſes, form the cavity for receiving the ſhoulder-bone. But ſtill, as if nature could not form a joint at once ſtrong and free, this joint, which performs quick, free, and eaſy motions, is too ſuperficial to be ſtrong. Yet there is this compenſation, that the ſhoulder-joint, which could not reſiſt, if fairly expoſed to ſhocks and falls, belongs to the ſcapula, which, ſliding eaſily upon the ribs, yields, and ſo eludes the force. Falls upon the ſhoulder do not diſlocate the ſhoulder; that accident almoſt always happens to us in putting out the hand to ſave ourſelves from falls; and the ſhoulder is luxated by a twiſting of the arm, not by the force of a direct blow.

The CLAVICLE.—The clavicle, or collar-bone, named clavicle from its reſemblance to an old faſhioned key, is to the ſcapula a kind of hinge or axis on which it moves and rolls; ſo that the free motion of the ſhoulder is made ſtill freer by the manner of its connection with the breaſt.

The clavicle is placed at the root of the neck, and at the upper part of the breaſt. It extends acroſs from the tip of the ſhoulder to the upper part of the ſternum; it is a round bone, a little flattened towards the end which joins the ſcapula; it is curved like an Italic *ſ*; having one curve turned out towards the breaſt: it is uſeful as an arch ſupporting the ſhoulders,

ders, preventing them from falling forwards upon the breaſt, and making the hands ſtrong antagoniſts to each other; which, without this ſteadying, they could not have been.

1. The thoracic end, that next the ſternum, or what may be called the inner head of the clavicle, is round and flat, or button-like; and it is received into a ſuitable hollow on the upper piece of the ſternum. It is not only like other joints ſurrounded by a capſule or purſe; it is further provided with a ſmall moveable cartilage, which (like a friction-wheel in machinery) ſaves the parts, and facilitates the motion, and moves continually as the clavicle rolls.

2. But the outer end of the clavicle is flattened as it approaches the ſcapula, and the edge of that flatneſs is turned to the edge of the flattened acromion, ſo that they touch but in one ſingle point. This outer end of the clavicle, and the correſponding point of the acromion, are flattened and covered with a cruſt of cartilage: but the motion here is very ſlight and quite inſenſible; they are tied firmly by ſtrong ligaments; and we may conſider this as almoſt a fixed point; for there is little motion of the ſcapula upon the clavicle; but there is much motion of the clavicle upon the breaſt: for the clavicle ſerves as a ſhaft or axis, firmly tied to the ſcapula, upon which the ſcapula moves and turns, being connected with the trunk only by this ſingle point, viz. the articulation of the clavicle with the breaſt-bone.

The OS HUMERI is one of the trueſt of the cylindrical bones; it is round in the middle; but it appears twiſted and flattened towards the lower end; and this flatneſs makes the elbow-joint a mere hinge, moving only in one direction. It is again regular and round towards the upper end; dilating into a large round head, where the roundneſs forms a very free and moveable joint, turning eaſily in all directions.

1. The HEAD of this bone is very large; it is neat and regularly circular; but it is a very ſmall portion of a large circle, ſo that it is flat: and this flatneſs of the head, with the ſhallowneſs of its glenoid cavity, makes it a very weak joint, eaſily diſplaced, and nothing equal to the hip-joint for ſecurity and ſtrength.

2. The NECK of this bone cannot fairly be reckoned ſuch; for, as I have explained in ſpeaking of the neck of the thigh-bone, this neck of the humerus and the necks of moſt bones (the thigh-bone ſtill excepted), are merely a rough line cloſe upon the head of the bone; without any ſtraitening or intermediate narrowneſs, which we can properly call a neck. The roughneſs round the head of the ſhoulder-bone is the line into which the capſular ligament is implanted.

3. The TUBEROSITIES of the os humeri are two ſmall bumbs of unequal ſize (the one called the greater, the other the ſmaller, tuberoſity of the os humeri), which ſtand up at the upper end of the bone, juſt behind the head: they are not very remarkable. Though much ſmaller than the trochanter of the thigh-bones, they ſerve ſimilar uſes, viz. receiving the great muſcles which move the limb. The GREATER TUBEROSITY is higher towards the outer ſide of the arm, and receives the ſupra ſpinatus muſcle; while the infra ſpinatus and teres minor muſcles, which

come from the lower part of the ſcapula, are implanted into the bone a little lower. The LESSER TUBEROSITY has alſo a great muſcle fixed into it, viz. the ſub-ſcapularis muſcle.

4. The two tuberoſities form betwixt them a groove, which is pretty deep; and in it the long tendon of the biceps muſcle of the arm runs: and as it runs continually, like a rope in the groove of a pulley, this groove is covered, in the freſh bones, with a thin cartilage, ſmooth, and like the cartilages of joints.

The os humeri, at its lower part, changes its form, is flattened and compreſſed below, and is ſpread out into a great breadth of two inches or more; where there is formed, on each ſide, a ſharp projecting point (named condyle), for the origin of great muſcles; and in the middle, betwixt the two condyles, there is a grooved articulating ſurface, which forms the hinge of the elbow.

1. At the lower end of the bone, there are two ridges, one leading to either condyle, which it is of ſome conſequence to obſerve; for the elbow-joint is a mere hinge, the moſt ſtrictly ſo of any joint in the body: it has, of courſe, but two motions, viz. flexion and extenſion; and it has two muſcles chiefly, one for extending, the other for bending, the arm. The flexor muſcle lies on the fore part, and the extenſor on the back part of the arm; and ſo the whole thickneſs of the arm is compoſed, at this place, of theſe two muſcles and of the bone: but that the fore and back parts of the arm might be thoroughly divided, the bone is flattened betwixt them; and that the diviſion might extend beyond the mere edges of

the bone, there are two faſciæ or tendinous webs which go off from either edge of the humerus, and which continue to divide the fore from the back muſcles, giving theſe muſcles a broader origin; they are named, from their office, intermuſcular membranes; and this is the meaning of the two ridges which lead to the two condyles.

2. The two projections in which theſe edges end are named CONDYLES. The condyles of the thigh-bone are the broad articulating ſurfaces by which that bone is joined with the tibia; while the condyles of the ſhoulder bone are merely two ſharp projecting points for the origin of muſcles, which ſtand out from either ſide of the joint, but which have no connection with the joint. The chief uſe of the condyles of the ſhoulder-bone is to give a favourable origin, and longer fulcrum, for the muſcles of the fore arm, which ariſe from theſe points. The outer tubercle being the ſmaller one, gives origin to the extenſor muſcles, where leſs ſtrength is required. But the inner tubercle is much longer, to give origin to the flexor muſcles with which we graſp; which require a bolder and more prominent proceſs to ariſe from; for greater power is needed to perform ſuch ſtrong actions as graſping, bending, pulling; while the muſcles which extend the fingers need no more power than juſt to antagoniſe or oppoſe the flexors; their only buſineſs being to unfold or open the hand when we are to renew the graſp.

It is further curious to obſerve, that the inner tubercle is alſo lower than the other, ſo that the articulating ſurface for the elbow-joint is oblique, which makes the hand fall naturally towards the face and breaſt, ſo that by being folded merely without any turning of the os humeri, the hands are laid acroſs.

3. The articulating ſurface which ſtands betwixt theſe condyles, forms a more ſtrict and limited hinge than can be eaſily conceived, before we explain the other parts of the joint. The joint conſiſts of two ſurfaces; firſt, a ſmooth ſurface, upon which the ulna moves only backwards and forwards; and, ſecondly, of a ſmall knob upon the inner tubercle, which has a neat round ſurface, upon which the face or ſocket belonging to the button-like end of the radius rolls. Theſe two ſurfaces are called the ſmall head, and the cartilaginous pulley of the humerus.

4. Belonging to the joint, and within its capſular ligament, there are two deep hollows, which receive certain proceſſes of the bones of the fore arm. One deep hollow on the fore part of the humerus, and juſt above its articulating pulley, receives the horn-like or coronoid proceſs of the ulna, the other receives the olecranon or that proceſs of the ulna which forms the point of the elbow.

RADIUS AND ULNA.

The radius and ulna are the two bones of the fore arm. The radius, named from its reſemblance to the ray or ſpoke of a wheel; the ulna, from its being often uſed as a meaſure. The radius belongs more peculiarly to the wriſt, being the bone which is chiefly connected with the hand, and which turns along with it in all its rotatory motions: the ulna, again, belongs more ſtrictly to the elbow-joint; for by it we perform all the actions of bending or extending the arm.

The

The ulna is in general of a triangular or priſmatic form, like the tibia, and the elbow is formed by the ulna alone; for there is a very deep notch or hinge-like ſurface, which ſeems as if it had been moulded upon the lower end of the humerus, embraces it very cloſely; and takes ſo ſure a hold upon the humerus, that it allows not the ſmalleſt degree of lateral motion, and almoſt keeps its place in the dry ſkeleton without the help of ligaments or muſcles; it preſents, in profile, ſomewhat of the ſhape of the letter S, and therefore is named the SIGMOID CAVITY of the ulna. 2. But this ſigmoid cavity were a very imperfect hinge without the two proceſſes by which it is guarded before and behind; the chief of theſe is the OLECRANON or large bump, which forms the extreme point upon which we reſt the elbow. It is a big and ſtrong proceſs, which, checking into a deep hollow in the back of the humerus, ſerves two curious purpoſes; it ſerves as a long lever for the muſcles which extend or make ſtraight the fore arm; and when by the arm being extended, it checks into its place, it takes ſo firm a hold upon the hinge or joint of the os humeri, as to ſecure the joint in pulling, and ſuch other actions as might cauſe a luxation forewards. 3. The other proceſs which guards the elbow-joint is named the CORONOID PROCESS, from its horn or pointed form; it ſtands up perpendicularly from the upper or fore part of the bone; it forms the fore part of the ſigmoid cavity, and completes the hinge. It is uſeful, like the olecranon, in giving a fair hold and larger lever to the muſcles, and in ſecuring the joint; for the arm being extended, as in pulling, the olecranon checks into its place, and prevents luxation forwards; and the arm again being bent, as in ſtriking, puſhing, or ſaving ourſelves from falls, the coronoid proceſs prevents luxation backwards. So the joint conſiſts of the olecranon and the coronoid proceſs as the two guards; and of the ſigmoid cavity or hollow of articulation betwixt them: but the ſmaller or upper head of the radius alſo enters into the joint, and lying upon the inner ſide of the coronoid proceſs, it makes a ſmall hollow there, in which it rolls; and this ſecond hollow, touching the edge of the ſigmoid cavity, forms a double ſigmoid cavity; of which the firſt, or GREATER SIGMOID CAVITY, is for receiving the lower end of the humerus; and the ſecond, or LESSER SIGMOID CAVITY, for receiving the upper head of the radius. 4. The form of the bone being priſmatic or triangular, it has, like the tibia, three ridges; one of which is turned towards a correſponding ridge in the radius, and betwixt them the interoſſeous ligament is ſtretched; and this interoſſeous ligament fills all the arch or open ſpace betwixt the radius and ulna, and ſaves the neceſſity of much bone; gives as firm an origin to the muſcles as bone could have done, and binds the bones of the fore arm together ſo ſtrongly, that though the ulna belongs entirely to the elbow-joint, and the radius as entirely to the wriſt, they have never been known to depart from each other, nor to yield to any force, however great*.

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* Sometimes the radius is luxated from the lower head of the ulna; but this diaſtaſis, as it is called, is quite of another kind.

5. The ulna, bigger at the elbow, grows gradually ſmaller downwards, till it terminates almoſt in a point. It ends below in a ſmall round head, which is named the LOWER HEAD of the ulna, which ſcarcely enters into the joint of the wriſt; but being received into a hollow on the ſide of the radius, the radius turns upon the lower head of the ulna like an axis or ſpoke.

6. Below this little head, the bone ends towards the ſide of the little finger in a ſmall rounded point, which is named the STYLOID PROCESS of the ulna, and which is chiefly uſeful in giving a ſtrong adheſion to the ligament which ſecures the wriſt there. And as the ſtyloid proceſs and the olecranon, the two extremities of the ulna, are eaſily and diſtinctly felt, the length of this bone has been uſed as a meaſure; and ſo it was named cubitus by the ancients, and is named ulna by us.

RADIUS. The radius is the ſecond bone of the fore arm, has its poſition exactly reverſed with that of the ulna: for the ulna belonging to the elbow has its greater end upwards; the radius belonging to the wriſt has its greater end downwards; and while the ulna only bends the arm, the radius carries the wriſt with a rotatory motion; and ſo entirely belongs to the wriſt, that it is called the manubrium manus, as if the handle of the hand.

1. The BODY of the radius is larger than that of the ulna. The tranſverſe ſtrength of the arm depends more upon the radius, which has more body and thickneſs; is more ſquared; and is arched, in ſome degree, ſo as to ſtand off from the ulna, without approaching it, or compreſſing the other parts. The ra-

dius lies along the upper edge of the fore arm, next to the thumb, and being, like the ulna, of a priſmatic or triangular form, it has one of its angles or edges turned towards the ulna to receive the interoſſeous ligament.

2. The UPPER HEAD of the radius is ſmaller; of a round, flattiſh, and button-like ſhape, and lies ſo upon the lower end of the ſhoulder-bone, and upon the coronoid proceſs of the ulna, that it is articulated with either bone; for, 1ſt, The hollow of its head is directly oppoſed to the little head of the os humeri; and, 2dly, The flat ſide of its button-like head rubs and turns upon the ſide of the coronoid proceſs of the ulna, making a ſocket there, which is called the leſſer ſigmoid cavity of the ulna.

[illegible]

3. Immediately behind the round flat head, is a narrowneſs or ſtraitening, called the NECK of the radius. Round this neck there is a collar or circular ligament (named the coronary ligament of the radius), which keeps the bone ſecurely in its place, turning in this ligamentous band like a ſpindle in its buſh or ſocket: for the radius has two motions, one accompanying the ulna in its movements of flexion and extenſion; and, ſecondly, its own peculiar rotation; in which it is not accompanied in return by the ulna, but the ulna continuing ſteady, the radius moves, and turns the wriſt.

4. Immediately under this neck, and juſt below the collar of the bone, there is a prominent bump, like a flat button, ſoldered upon the ſide of the bone; which is the point into which the biceps flexor cubiti, or bending muſcle of the fore arm, is inſerted.

5. The upper head is exceedingly ſmall and round, while the LOWER HEAD ſwells out, broad and flat, to receive the bones of the wriſt. There are two greater bones in the wriſt, which form a large ball, and this ball is received into the lower end of the radius: the impreſſion which theſe two bones make there is pretty deep, and ſomewhat of a boat-like ſhape; whence it is called (like the articulating ſurface of the tibia) the ſcaphoid cavity of the radius; and on the edge of the radius, next to the thumb, the bone ends in a ſort of peak or ſharper point, which is named (though with very little meaning) the STYLOID PROCESS of the radius.

So the ſcaphoid cavity of the radius forms the joint with the wriſt; but there is another ſmall cavity, on the ſide of the radius, near to the little head of the ulna, into which this leſſer head of the ulna is received; and this is incloſed in a proper and diſtinct capſule. The little head of the ulna does not deſcend ſo low as to have any ſhare in forming the wriſt. There are properly two diſtinct joints; the great joint of the wriſt, moving upon the radius, the other a little joint within this of the radius, rolling upon the ulna, and carrying the wriſt along with it.

OF THE HAND AND FINGERS.

The wriſt is the moſt complex part of all the bony ſyſtem, and is beſt explained in a general way, by marking the three diviſions of the hand, into the carpus or wriſt bones; the metacarpus, or bones that ſtand upon the wriſt; and the fingers, conſiſting each of its three joints. 1. The carpus or wriſt is a congeries of eight ſmall bones; grouped together into a very narrow ſpace; very firmly tied together by croſs ligaments; making a ſort of ball or nucleus, a ſolid foundation or centre for the reſt of the hand. 2. The metacarpus is formed of five long bones, founded upon the carpal bones; and which, departing from that centre, in ſomewhat of a radiated form, give, by their ſize and ſtrength, a firm ſupport to each individual finger, and, by their radiated or ſpoke-like form, allow the fingers freer play. 3. The fingers, conſiſting each of three very moveable joints, are ſet free upon the metacarpus; ſo as to ſhow a curious gradation of moving in all theſe parts; for the carpal bones are grouped together into a ſmall nucleus, firm, almoſt immoveable, and like the nave of a wheel; then the metacarpal bones, founded upon this, are placed like the ſpokes or fillies of the wheel, and have a freer motion; and, laſtly, the fingers, by the advantage of this radiated form in the bones upon which they are placed, move very nimbly, and have a rotatory as well as a hinge-like motion. So that the motion is graduated and proportioned in each diviſion of the hand; and even where there is no motion, as in the carpus, there is an elaſticity, which, by gentle bendings, accommodates itſelf to the more moveable parts.

The CARPUS, or WRIST.—Looking upon the external ſurface of the carpus, we count eight ſmall bones diſpoſed in two rows, with one bone only a little removed from its rank; and we obſerve that the whole is arched outwards, to reſiſt injuries, and to give ſtrength; and that the bones lie like a pavement, or like the ſtones of an arch, with their broader ends turned outwards.

wards. On the internal ſurface, again, we find the number of bones not ſo eaſily counted; for their ſmaller ends are turned towards the palm of the hand, which being a concave ſurface, the narrow ends of the wedges are ſeen huddled together in a leſs regular form, crowded, and lapped over each other; but in this hollow, the four corner bones are more remarkable, projecting towards the palm of the hand, ſo as to be named proceſſes: and they do indeed perform the office of proceſſes; for there ariſes from the four corner points a ſtrong croſs ligament, which binds the tendons down, and makes under it a ſmooth floor or gutter for them to run in.

The individual bones of the carpus are ſmall, cornered, and very irregular bones; ſo that their names do but very poorly repreſent their form. To deſcribe them without ſome help of drawing, or of demonſtration, is ſo very abſurd, that a deſcription of each of them ſeems more like a riddle than like a ſerious leſſon: it cannot be underſtood, and indeed it need hardly be remembered; for all that is uſeful is but to remember the connection and place, and the particular uſes, of each bone; in reading of which, the ſtudent ſhould continually return to the plates, or he muſt have the bones always in his hand.

I. ROW FORMING THE WRIST.

1. Os SCAPHOIDES—The boat-like bone. This name of boat-like bone, or boat-like cavity, has been always a favourite name, though a very unmeaning one. The ſcaphoid bone is not worthy of notice merely from its

being the largeſt, but alſo as it forms a chief part of the joint of the wriſt; for it is this bone which is received into the ſcaphoid cavity of the radius. It is a very irregular bone; in which we need remember only theſe two points; the large round ſurface covered with cartilage, ſmooth, and anſwering to the cavity in the head of the radius; and the hook-like, or projecting proceſs, which forms one of the corner points of the carpus, and gives a hold to one corner of the ligament which binds down the tendons of the wriſt.

2. The OS LUNARE is named from one of its ſides being ſomewhat of the ſhape of a half moon; it is next in ſize to the ſcaphoid bone, and is equal to it in importance; for they are joined together, to be articulated with the radius. This bone takes an equal ſhare in the joint with the ſcaphoid bone; and together they form a great ball, fitting the ſocket of the radius, and of a long form, ſo that the wriſt is a proper hinge. The lunated edge of the os lunare is turned towards the ſecond row of bones, and therefore is not ſeen. And the chief marks of this bone are its greater ſize; its lunated edge, turned towards the ſecond row; and its round head forming the ball of the wriſt-joint.

3. The OS CUNEIFORME, or wedge-like bone, is named rather perhaps from its ſituation, locked in among the other bones, than ſtrictly from its form. Its ſide forming the convex of the hand, is broader; its point towards the palm of the hand is narrower; and ſo far, we may ſay, it is a wedge-like bone: but it is chiefly ſo from its ſituation, cloſely wedged in betwixt the unciform and piſiform bones.

4. The OS PISIFORME is a ſmall neat and round bone, named ſometimes ORBICULAR, or round bone, but oftener piſiform, from its reſemblance to a pea. It is placed upon the cuneiform bone, and ſtands off from the reſt into the palm of the hand, ſo as to be the moſt prominent of all the corner bones; of courſe it forms one of the corner points or pillars of that arch, under which the tendons paſs. The piſiform bone is a little out of its ranks; is very moveable; and projects ſo into the palm, as to be felt outwardly, juſt at the end of the ſtyloid proceſs of the ulna; it can be eaſily moved and rolled about; and is the point into which is implanted one of the ſtrong muſcles for bending the wriſt.

2. ROW SUPPORTING THE METACARPAL BONES.

5. The ſecond row begins with the TRAPEZIUM; a pretty large bone, which, from its name, we ſhould expect to find of a regular ſquared form; while it has, in fact, the moſt irregular form of all, eſpecially when detached from the other bones. The chief parts to be remarked in the bone, are the great ſocket for the thumb; and as the thumb ſtands off from one ſide of the hand, this ſocket is rather on one ſide. There is alſo a little proceſs which makes one of the corner points.

6. The TRAPEZOIDES is next to the trapezium; is ſomewhat like the trapezium; from which it has its name. It alſo reſembles the cunieform bone of the firſt row in its ſhape and ſize, and in its being wedged in betwixt the two adjoining bones.

7. The os MAGNUM is named from its great ſize; not that it is the largeſt of all, nor even the largeſt bone of the ſecond row, for the cuneiform bone is as big; but there is no other circumſtance by which it is well diſtinguiſhed. It is placed in the centre of the upper row, has a long round head, which is jointed chiefly with the lunated hollow of the os lunare; and this big head, and lunated hollow, make together a ſort of ſocket, by which the ſecond row moves upon the firſt.

8. The os UNCIFORME, or hook-like bone, is named from a flat hook-like proceſs, which projects towards the palm of the hand. This is one of the corner bones, and ſtanding in the end of the row, it is wedged betwixt the os magnum of its own row, and the os cuneiforme of the firſt row. It is large and ſquared; but the thing chiefly remarkable is that proceſs from which it take its name; a long and flat proceſs of firm bone, fairly unciform, or hook-like, and projecting far into the palm of the hand, which being the laſt and higheſt of the corner points, gives a very firm origin to the great ligament by which the tendons of the wriſt are bound down.

All theſe bones of the carpus, when they are joined to each other, are covered with a ſmooth articulating cartilage; are bound to each other by all forms of croſs ligaments; and are conſolidated, as it were, into one great joint. They are, in general, ſo firm as to be ſcarcely liable to luxation; and although one only is called cuneiform, they are all ſomewhat of the wedge-like form, with their broader ends outwards, and their ſmaller ends turned towards the palm of the hand;

they

they are like ſtones in an arch, ſo that no weight nor force can beat them in; if any force do prevail, it can beat others in only by forcing one out. A bone ſtarting outwards, and projecting upon the back of the hand, is the only form of luxation among theſe bones, and is extremely rare.

METACARPUS.—The metacarpus is compoſed of five bones, upon which the fingers are founded. They are big ſtrong bones; brought cloſe together at the root, but wider above; for the lower heads are ſmall and flat, and grouped very cloſely together, to meet the carpal bones; but they ſwell out at their upper ends into big round heads, which keep the bones much apart from each other. Nothing of importance can be ſaid concerning the individual bones. To ſpeak of them individually is a mere waſte of time. We may obſerve of the metacarpal bones in general, 1. That their lower heads being flat and ſquared, gives them a firm implantation upon their centre or nucleus, the carpus; and that they have ſcarcely any freer motion upon the carpal bones, than the carpal bones have upon each other. 2. That their lower heads being larger, keeps the bones apart from each other; and in the interſtices between them lie the interoſſeous muſcles. 3. That their divergence regulates the radiated or ſpreading form of the fingers, and gives them free play. And, 4. That they ſtill preſerve the arched form of the carpal bones, being, with the carpal bones, convex outwardly, and concave inwardly, to form the hollow of the hand; and though they have little motion of flexion or extenſion, they bend towards a centre, ſo as to approach each other, increaſing the hollowneſs of the hand, to form what is called Diogenes's cup. It is farther neceſſary to obſerve, into how ſmall a ſpace the carpal bones are compreſſed; how great a ſhare of the hand the metacarpal bones form; and how far down they go into the hollow of the hand. For I have ſeen a ſurgeon, who, not having the ſmalleſt ſuſpicion that their lower ends were ſo near the wriſt as they really are, has, in place of cutting the bone neatly in its articulation with the carpus, broken it, or tried to cut it acroſs in the middle.

FINGERS.—We commonly ſay, that there are five metacarpal bones; in which reckoning we count the thumb with the reſt: but what is called the metacarpal of the thumb is properly the firſt phalanx, or the firſt proper bone of the thumb; ſo that the thumb, regularly deſcribed, has, like the other fingers, three joints.

THUMB.—The firſt bone of the thumb reſembles the matacarpal bones in ſize and ſtrength, but it differs widely in being ſet upon the carpus with a large and round head; in being ſet off from the line of the other fingers, ſtanding out on one ſide, and directly oppoſed to them. It rolls widely and freely, like other ball and ſocket joints: it is oppoſed to the other fingers in graſping, and, from its very ſuperior ſtrength, the thumb is named Polex, from polere.

The FINGERS have each of them three bones. 1. The firſt bone is articulated with the metacarpal bones by a ball and ſocket; the ſocket, or hollow on the lower part of the firſt finger bone, being ſet down upon the large round head of the metacarpal bone. 2. The ſecond and third joints of the fingers are gradually ſmaller, and though their forms do a good deal reſemble the firſt joint, they are quite limited in their motions; have no rolling; are as ſtrictly hinge-joints as the knee or ankle are. 3. Here, as in other hinge-joints, the capſule is ſo particularly ſtrong at the ſides, as to be named lateral ligaments. When theſe lateral ligaments are burſt or cut, the finger turns in any direction; ſo that the motions of the fingers are limited rather by their lateral ligaments, than by any thing peculiar in the forms of the bones. 4. The face of each finger bone is grooved, ſo that the tendons, paſſing in the palm of the hand, run upwards along this groove or flatneſs of the fingers; and from either edge of this flatneſs, there riſes a ligament of a bridge-like form, which covers the tendons like a ſheath, and converts the groove into a complete canal. 5. The laſt joint or phalanx of each finger is flattened, rough, and drawn ſmaller gradually towards the point of the finger; and it is to this roughneſs that the ſkin and nail adhere at the point.

BOOK II.

OF THE MUSCLES.

CHAP. I.

MUSCLES OF THE FACE, EYE, AND EAR.

I. MUSCLES OF THE FACE.

1. THE OCCIPITO FRONTALIS is a broad and thin muſcular expanſion, which covers all the upper part of the cranium. It conſiſts of two bellies, with an intermediate ſheet of flat tendon. The one belly covers the occiput; the other covers the forehead; and the tendinous expanſion covers all the upper part of the head: by which it has happened that the moſt eminent anatomiſts, as Cowper (p. 29.) have miſnamed its tendon, pericranium: many have reckoned it two diſtinct muſcles, viz. the OCCIPITAL and FRONTAL; while others (becauſe of a ſort of rapha, or line of diviſion in the middle of each belly) have deſcribed four muſcles, viz. two frontal, and two occipital muſcles. But it is truly a double bellied muſcle; and the broad

thin tendon, which belongs equally to both bellies, lies above the true pericranium, and ſlides upon it. The muſcle is therefore named, with ſtrict propriety, OCCIPITO-FRONTALIS, ſometimes EPICRANIEUS, ſometimes BIVENTER, or DIGASTRICUS CAPITIS.

ORIGIN.—The occipital portion is the fixed point of this muſcle; ariſing from the upper ridge of the occipital bone, and covering the back part of the head, from the maſtoid proceſs of one ſide, round to that on the oppoſite ſide of the head. And by the perpendicular ridge of the occiput, it is marked with a ſlight diviſion in the middle.

INSERTION.—The fore belly of the muſcle which covers the forehead, is fixed more into the ſkin and eye-brows than into the bone: it is ſlightly attached to the bone, near the inner end of the orbitary ridge, and eſpecially about the inner corner of the eye, and the root of the noſe, by a ſmaller and acute pointed proceſs; but ſtill its chief attachment is to the eye-lids and ſkin.

The TENDON or thin MEMBRANEOUS expanſion which joins the two bellies, is exceedingly thin: it has on its inner ſide much looſe cellular ſubſtance, by which, though attached to the true pericranium, it ſlides eaſily and ſmoothly upon it; but its outer ſurface is ſo firmly attached to the ſkin, and its fore belly adheres ſo firmly to the eye-brows, that it is very difficult to diſſect it clean and fair.

I conſider the occipital belly as the fixed point, having a firm origin from the ridge of the bone; its frontal belly has the looſe end attached, not to the os frontis, but to the eye-brow and ſkin; and its office is to raiſe the eyebrows, wrinkle the forehead, and corrugate the whole of the hairy ſcalp, like that muſcle under the ſkins of animals which ſhrinks when they are cold or rudely touched, and by which they ſhake off flies or inſects. But it is a muſcle employed more in expreſſing paſſions than in performing uſeful motions; and it is often ſo thin as hardly to be perceived. In ſome it is entirely awanting; and many who have the muſcle, have no command nor power over it.

There is a ſmall, neat, and pointed ſlip of the occipito-frontalis, which goes down with a peak towards the noſe, and is inſerted into the ſmall naſal bone. This proceſs, being much below the end of the eyebrow, muſt pull it downwards; ſo that while the great muſcle raiſes the eyebrow and ſkin of the forehead, this ſmall naſal ſlip pulls the eyebrow downwards again, reſtoring it to its place, and ſmoothing the ſkin. It may be conſidered as the antagoniſt of the great occipital and frontal bellies, and might almoſt be deſcribed as a diſtinct muſcle.

II. The CORRUGATOR SUPERCILII is another ſlip which might be fairly enough referred, like this, to the occipital muſcle; but being in may ſubjects particularly ſtrong, it is beſt deſcribed as diſtinct. The lower end of the naſal ſlip of the occipito-frontalis is fixed to the naſal bone; the lower end of the little ſlip, the corrugator ſupercilii, is fixed into the internal angular proceſs; and from the inner angle of the eye, the fibres ſweep round the edge of the orbit, and going obliquely upwards and outwards, are ſo mixed with the fibres of the frontal muſcle, and of the orbicularis oculi, where theſe two touch each other, that it is doubtful to which of thoſe greater muſcles this little one might be moſt proprely referred. So this ſlip of oblique fibres, riſing from the inner angle of the eye, and being fixed into the eyebrow, alſo antagonizes the occipito-frontalis; and drawing the eyebrows together, and wrinkling the ſpace betwixt them, is very rightly named CORRUGATOR SUPERCILII.

III. ORBICULARIS OCULI, or PALPEBRARUM, is a neat and regular muſcle, ſurrounding the eye, and covering the eyelids in a circular form. It is exceedingly flat and thin; is about an inch in breadth; lies immediately under the ſkin of the eyelids; and is immediately attached to them, and but little connected with the bone. It has one ſmall tendon in the inner corner of the eye, which is both its origin and inſertion; for it begins and ends in it. This ſmall tendon is eaſily felt through the ſkin in the inner corner of the eye. It ariſes by a little white knot from the naſal proceſs of the upper jaw-bone. Its fibres immediately become muſcular, and ſpread out thin over the upper eyelid. They paſs over it to the outer corner of the eye, where they croſs a little, and having covered juſt the edge of the temple with their thin expanded fibres, they return in a circular form round by the lower eyelid to the point from whence they had ſet out. This is, in all its courſe, a very thin muſcular expanſion, with regular orbicular fibres. It is rather a little broader over the lower eyelid; extends itſelf a little upon the face beyond the brim of the ſocket, both at the temple and upon the cheek; and its fibres croſs each other a little at the outer angle; ſo that ſome, underſtanding this croſſing as a meeting of fibres from the upper and from the lower muſcle, have deſcribed it as two ſemicircular muſcles. And thoſe fibres which are next to the tarſus or cartilaginous circle of the eyelids, were diſtinguiſhed by Riolan under the title of MUSCULUS CILIARIS. Our name expreſſes the common opinion, that it is a circular muſcle, whoſe chief point or fulcrum is in the inner corner of the eye, and which ſerves as a ſphincter for cloſing the eye. It ſqueezes with ſpaſmodic violence when the eye is injured, as by duſt. And by its drawing down the eyelids ſo firmly, it preſſes the ball of the eye down into the ſocket, and forces the lachrymal gland that is within the ſocket, ſo as to procure a flow of tears. Perhaps the corrugator ſupercilii belongs ſtrictly to this muſcle, ſince its fibres follow the ſame courſe.

IV. LEVATOR PALPEBRÆ SUPERIORIS.—This ſmall muſcle ariſes deep within the ſocket, from the margin of that hole which gives paſſage to the optic nerve. It begins by a ſmall flat tendon in the bottom of the optic cavity; becomes gradually broader as it goes over the eyeball; it ends in the eyelid by a broad expanſion of muſcular fibres, which finally terminate in a ſhort flat tendon. It lies under the orbicularis palpebræ; is inſerted into the whole length of the cartilage of the tarſus; and raiſes and opens the upper eyelid. And the diviſion of the orbicularis oculi into two, by the older anatomiſts, was a conſequence of their not knowing of the true levator palpebræ, and their not being able to deſcribe any muſcle by which the upper eyelid could be raiſed, except the upper half of the orbicularis.

The occipito-frontalis, but eſpecially its occipital belly, raiſes the eyebrows; the pointed ſlip of the ſame muſcle pulls them downwards; the corrugator pulls them directly inwards, and knits the brows; the levator palpebræ opens the eyelid; and the orbicularis oculi cloſes the eye. Whether certain fibres from the platiſma-myoides (a thin flat muſcle which mounts from the neck over the cheek) may not pull down the lower eyelid; or whether ſome ſtraggling fibres, ariſing from the zygoma, may not have the appearance of a depreſſor of the lower eyelid, it is not neceſſary to determine, ſince there is no regularly appointed muſcle; and the lower eyelid is almoſt immoveable, at leaſt in man.

MUSCLES OF THE NOSE AND MOUTH.

V. Levator labii superioris et alæ nasi. Cowper deſcribes the levator labii ſuperioris as an irregular production of the frontalis, extending along the noſtrils. But it is a neat and delicate muſcle, which ariſes, by a ſmall double tendon, from the naſal proceſs of the upper jaw-bone, cloſe by the tendon of the orbicularis oculi. It is one little faſciculus of muſcular fibres above; but as it approaches the noſe, it ſpreads out broader, dividing into two ſmall faſciculi; one of which is implanted into the wing or cartilage of the noſe, and the other, paſſing the angle of the noſe, goes to the upper lip. Thus it is pyramidal with its baſe downwards, and was named pyramidalis by Caſerius, Winſlow, and others. It is called by Cowper dilator alæ naſi. It raiſes the upper lip, and ſpreads the noſtrils wide, as is obſerved in a paroxyſm of rage, or in aſthmatics.

VI. The LEVATOR LABII SUPERIORIS PROPRIUS, is diſtinguiſhed by the name of levator proprius, becauſe there are two others; one belonging to the angle of the mouth, and conſequently to both lips; and one common to the lip and noſtril.

The levator proprius is often named muſculus inciſivus, becauſe it ariſes from the upper jaw, juſt above the inciſores or cutting teeth, and conſequently juſt under the edge of the orbit: it is broad at its origin; it lies flat, and runs downwards, and obliquely inwards, to the middle of the lip, till it meets its fellow juſt in the filtrum *. It pulls the upper lip and the ſeptum of the noſe directly upwards.

VII. The LEVATOR ANGULI ORIS, is called alſo LEVATOR COMMUNIS LABIORUM, becauſe it operates equally on both lips. It is named CANINUS; for as the laſt named muſcle riſes from the upper jaw-bone above the inciſores or cutting teeth, this ariſes above the canini or dog teeth, or above the firſt grinder, by a very ſhort double tendon. The exact place of its origin is half-way betwixt the firſt grinder and the infra orbitary hole: it is mixed with the orbicularis oris, at the corner of the mouth, ſo that it raiſes the angle of the mouth upwards.

VIII. The ZYGOMATICUS MAJOR has nearly the ſame direction and uſe with this one: for it ariſes from the cheek-bone near the zygomatic ſuture; runs downwards

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* The filtrum is the ſuperficial gutter along the upper lip from the partition of the noſe to the tip of the lip.

wards and inwards to the corner of the mouth ; is a long and ſlender muſcle, which ends by mixing its fibres with the orbicularis oris and the depreſſor of the lip.

IX. The ZYGOMATICUS MINOR ariſes a little higher upon the cheek-bone, but nearer the noſe ; it is much ſlenderer than the laſt, and is often awanting.

It is the zygomatic muſcle that marks the face with that line which extends from the cheek-bone to the corner of the mouth, and which is ſo ſtrong in many. The zygomatic muſcles pull the angles of the mouth upwards as in laughter ; or diſtort the mouth ; whence the zygomatic muſcle has gotten the name of diſtortor oris ; and the ſtrong action of the muſcle is particularly ſeen in laughter, rage, grinning.

X. BUCCINATOR. The buccinator was long thought to be a muſcle of the lower jaw, ariſing from the upper alveoli, and inſerted into the lower alveoli to pull the jaw upwards ; but its origin and inſertion, and the direction of its fibres, are quite the reverſe of this. For this large flat muſcle, which forms, in a manner, the walls of the cheek, ariſes chiefly from the coronoid proceſs of the lower jaw-bone, and partly alſo from the end of the alveoli or ſocket proceſs of the upper jaw, cloſe by the pterygoid proceſs of the ſphenoid bone : it goes forwards with direct fibres to be implanted into the corner of the mouth : it is thin and flat, covers in the mouth, and forms the walls of the cheek, and is perforated in the middle of the cheek by the duct of the parotid gland. Theſe are its principal uſes : That it flattens the cheek, and ſo aſſiſts in ſwallowing liquids : that it turns, or helps to turn, the morſel in the mouth while chewing, and prevents it from getting without the line of the teeth: in blowing wind inſtruments, it both receives and expels the wind: it dilates like a bag, ſo as to receive the wind in the cheeks; and it contracts upon the wind, ſo as to expel the wind, and to ſwell the note. In blowing the ſtrong wind inſtruments, we cannot blow from the lungs, for it ſtreſſes the breathing, but reſerve the air in the mouth, which we keep continually full; and from this it is named, from blowing the trumpet, the BUCCINATOR.

XI. DEPRESSOR ANGULI ORIS.—The depreſſor anguli oris is a neat ſmall triangular muſcle, and is indeed very commonly named MUSCULUS TRIANGULARIS LABIORUM, from its ſhape. The baſe of the triangle is at the line of the lower jaw, where the muſcle riſes with a flat fleſhy head about an inch in breadth. It grows ſmaller gradually as it riſes towards the corner of the mouth, where it is implanted, ſmall, almoſt in a point, and directly oppoſite to the zygomatic and levator muſcles; and as the zygomatic muſcle makes a line from the cheek down to the angle of the mouth, this makes a line from the chin up to the corner of the mouth. It is chiefly active in expreſſing the paſſions, and gives form to the chin and mouth. In cheerful motions, as laughter, ſmiling, &c. the zygomatics and levators pull the angles of the mouth upwards. In fear, hatred, revenge, contempt, and the angry paſſions, the triangulares pull the corners of the mouth downwards. And, at the place where theſe meet, there is formed a ſort of riſing at the angle of the mouth: for a great many tendons are crowded into this one point; the zygomatic, levator, depreſſor, and orbicularis oris muſcles meeting and croſſing each other at this place.

XII. The DEPRESSOR LABII INFERIORIS is a ſmall muſcle, the diſcovery of which Cowper claims for himſelf. It is a ſmall muſcle, lying on each ſide of the chin, which, with its fellow, reſembles very much the levators of the upper lip. The depreſſor labii inferioris ariſes on each ſide of the chin, from the lower jaw-bone, under the line of the triangular muſcle. It goes obliquely upwards and inwards, till it meets its fellow in the middle of the lip; and where the muſcles of the oppoſite ſide meet, there is a little filtrum or furrow on the lower lip, as on the upper one. It mixes its fibres with the orbicularis, and its uſe is to pull the lip downwards. Each muſcle is of a ſquare form, and thence has been often named QUADRATUS GENÆ, the ſquare muſcle of the chin.

XIII. The ORBICULARIS ORIS, or muſcle round the mouth, is often named CONSTRICTOR ORIS, SPHINCTER, or OSCULATOR. It is very regular; it is an inch in breadth, and conſtitutes the thickneſs of the lips: it lies in the red part of the lips, and is of a circular form, ſurrounding the mouth after the ſame manner that the orbicularis oculi encircles the eye. We ſee a degree of croſſing in the fibres at the angles of the mouth, whence it has been conſidered by many, not as a circular muſcle, but as one conſiſting of two ſemicircular muſcles, the SEMI-ORBICULARIS SUPERIOR, and SEMI-ORBICULARIS INFERIOR. Its fixed points are the two angles of the mouth; at that ſwelling which is formed by the union of the zygomatic, triangular, and other muſcles: And its chief uſe is to contract the mouth, and to antagonize the other muſcles which I have juſt deſcribed. Often a ſmall ſlip runs up from the middle of the upper lip to the tip of the noſe; it is the NASALIS LABII SUPERIORIS of Albinus; it lies exactly in the furrow of the filtrum, and is occaſionally a levator of the upper lip, or a depreſſor of the tip of the noſe.

Theſe muſcles of the noſe and lips are not uſeful merely in expreſſing the paſſions; that is but a ſecondary and accidental uſe, while their great office is to perform thoſe continual movements which breathing, ſpeaking, chewing, ſwallowing, require. There are muſcles for opening the mouth in various directions, which are all antagonized by this one, the orbicularis oris. The levator labii ſuperioris, and the depreſſor labii inferioris, ſeparate the lips, and open the mouth. The levator anguli oris, along with the zygomatic muſcles, raiſes the cheek, and dilates the corners of the mouth. The buccinator pulls the corner of the mouth directly backwards, opening the mouth. The angularis oris alſo dilates the mouth, pulls the angles of the mouth downwards and backwards, and forms it into a circle, if the others act at the ſame time; but the orbicularis oris is the largeſt and ſtrongeſt (formed, as it were, by the fibres of all theſe taking a new direction, and turning round the lips), ſhuts the mouth, and antagonizes them all: and from an opening as wide as the mouth can require, ſhuts the mouth at pleaſure, ſo cloſely as to retain the very breath againſt all the force of the lungs. It is the true antagoniſt of all the other muſcles; and they and the orbicularis mutually react on each other, in alternately opening and cloſing the mouth. This phenomenon of the orbicularis muſcle dilating to ſuch a wideneſs, and in an inſtant cloſing the mouth again with ſuch perfect accuracy as to retain the breath, puts to nought all the vain calculations about the contraction of muſcles; as that they can contract no more than one third of their length; for here is an infinite contraction, ſuch as no proceſs can meaſure. It is a paralyſis of theſe muſcles, that ſo often occaſions a hideous diſtortion of the face; for when the one ſide of the body falls into palſy, the muſcles of one cheek ceaſe to act; the muſcles of the other cheek continue to act with their uſual degree of power. This contraction of the muſcles of one cheek excites alſo the orbicularis oris to act, and ſo the mouth is purſed up, and the lips and angles of the mouth are drawn towards one ſide.

There are ſome ſmaller muſcles which, lying under theſe, could not be deſcribed without danger of confuſion; as—

XIV. The DEPRESSOR LABII SUPERIORIS et ALÆ NASI, which is very ſmall, and lies concealed under the other muſcles. It riſes from the gum or ſocket of the fore teeth, and thence is named by Winſlow inciſivus medius. It goes into the riſing of the noſe, and pulls it, and of courſe the upper lip, down; and is named by Albinus and Cowper conſtrictor vel compreſſor alæ naſi.

XV. The CONSTRICTOR NASI, or compreſſor of the noſe, is a ſmall ſcattered bundle of muſcular fibres, which croſſes the wings, and goes to the very point of the noſe; for one ariſes from the wing of the noſe on each ſide, and meets its fellow in the middle ridge, where both are fixed into the middle cartilage, or into the lower point of the NASAL bones; meeting with the peak of the frontal muſcle, or its ſcattered fibres. But this muſcle is ſo difficultly found, that when Cowper ſaw it diſtinctly marked in Bidloe's 12th table, he conſidered it as a fiction, having ſought for it very carefully, but in vain.

And XVI. The LEVATOR MENTI, which ariſes from the lower jaw, at the root of the cutting teeth, has been named INCISIVUS INFERIOR. It is inſerted into the ſkin, on the very centre of the chin: by its contraction it draws the centre of the chin into a dimple; and from its moving the under lip at the ſame time, it is named LEVATOR LABII INFERIORIS.

MUSCLES OF THE EXTERNAL EAR.

THOUGH perhaps not one of ten thouſand has the power of moving the outward ear, yet there are many thin and ſcattered fibres of muſcles about the root of the cartilage of the ear, to which we cannot refuſe the name and diſtinction of muſcles; and which ſerve, indeed, to indicate, that nature had intended a degree of motion, which, perhaps by the manner of covering the heads of children, we may have loſt. But in a few theſe faſciculi of fibres have not the form only, but the uſes alſo, of muſcles. The celebrated Mr Mery was wont, when lecturing on this ſubject, to amuſe his pupils, ſaying, pleaſantly, "that in one thing, he ſurely belonged to the long-eared tribe;" upon which he moved his ears very rapidly backwards and forwards*.

XVII. Superior auris is named attollens, becauſe it lifts the ear upwards: it is a very thin, flat, expanſion, which can hardly be diſtinguiſhed from the faſcia of the temporal muſcle, upon which it lies; it ariſes broad and circular from the expanded tendon of the occipito-frontalis, and is inſerted narrow into the root of the cartilaginous tube of the ear.

XVIII. Anterior auris is a very delicate, thin, and narrow expanſion; ariſing about the zygoma, or rather from the faſcia with which the zygoma is covered; it is implanted round the cartilaginous tube, at its root †.

XIX. The posterior auris is alſo a ſmall muſcle, very delicate and thin; but the anterior riſes in one ſmall and narrow ſlip only, while this, the poſterior, riſes commonly in three narrow and diſtinct ſlips, from about the place of the maſtoid proceſs‡; whence it is often named triceps auris. It goes directly forwards to be implanted into the concha. It is named retrahens auris from its office.

But there are ſtill other muſcles enumerated, which are not for moving the outward ear upon the head, but for moving, or rather bending, the individual parts of the ear upon each other. Thoſe fibres, which are miſnamed muſcles, are merely muſcular membranes, which have none of the marks nor offices of true muſcles; they have ſeldom fleſhy fibres, and the parts upon which they lie are fixed. Heiſter denies them the title of muſcles, and calls them muſcular membranes only.

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* Vide Palſin, who was his pupil. The celebrated Albinus could move his ears.

† We ſeldom find an anterior auris, or any thing different from the anterior fibres of the attollens.

‡ Fibræ carneæ tranſverſæ, a nobis deſcriptæ Valsalva.

The ring and other bendings of the outward ear are called helix and antihelix, tragus and antitragus; and this determines the names of theſe ambiguous fibres, which are ſometimes found lying upon theſe circles of the outward cartilage, juſt under the ſkin.

XX. The MUSCULUS HELICIS MAJOR lies upon the upper or ſharp point of the helix, or outward ring.

XXI. HELICIS MINOR riſes lower than the former, upon the part of the helix.

XXII. The TRAGICUS lying upon the concha, and ſtretching to the tragus.

XXIII. The ANTITRAGICUS lies in the antitragus.

XXIV. And, laſtly, There is the TRANSVERSUS AURIS of Albinus.

MUSCLES OF THE EYEBALL.

THE eyeball is entirely ſurrounded by muſcles, which turn it in all directions. There is one muſcle on either ſide; one above, and one below; theſe ariſe from the very bottom of the ſocket, ſpread out upon the ball of the eye, and are implanted into its forepart, where the expanſions of their colourleſs tendons form what is called the white of the eye. Now, theſe four muſcles being directly above, below, and on either ſide of the eye, are called the recti, or ſtraight muſcles; for their pulling is from the bottom of the ſocket,

ſocket. But there are other two muſcles which are named the oblique muſcles, becauſe they pull from the edges of the ſocket, and turn the eye obliquely; for they go in a direction exactly oppoſite to the recti. The recti come directly forwards from the bottom of the orbit; theſe go obliquely backwards from the edge of the orbit; one riſes from the lower edge of the ſocket, and goes backwards under the eyeball; the other riſes indeed, along with the recti, in the bottom of the ſocket, but it has a cartilaginous pulley on the very edge of the ſocket, at its upper part; and its ſmall round tendon firſt runs through this pulley, and then turns down upon the eye, and goes backwards; ſo that the ſtraight muſcles preſs down the eyeball deep into the ſocket, while the oblique muſcles bring the eyeball forwards, pulling it outwards from the ſocket.

The trueſt deſcription of the recti is as of one muſcle, ſince their only variety is that difference of place, which is expreſſed by the name of each. They all agree in theſe chief circumſtances, that they ariſe by flat, but ſmall tendons, round the margin of the optic hole, ariſing from the circle of that hole, or rather from the perioſteum there; and there being one above, one below, and one on either ſide, they completely ſurround the optic nerve, and adhere to it. They are neat and delicate muſcles, gradually expanding each into a fleſhy belly, which ſurrounds and covers the middle of the ball of the eye. They ſtill go on expanding, till they at laſt terminate, each in a broad, flat, and very white tendon, which covers all the fore part of the eye, up to the circle of the lucid cornea or window; and their white and ſhining tendons form that enamelled-like part which lies behind the coloured circle, and which is, from its colour, named the white of the eye, or the TUNICA ALBUGINEA, as if it were abſolutely a diſtinct coat.

Now, the only difference in theſe ſtraight muſcles is in reſpect of length; for the optic nerve enters the eye, not regularly in the centre, but a little towards the inner ſide, ſo that the rectus internus, or muſcle neareſt the noſe, is a little ſhorter. The rectus externus, or muſcle neareſt to the temple, is a little longer; while the rectus ſuperior and the rectus inferior are nearly of equal length. The uſes of theſe muſcles are exceedingly plain.

XXV. The RECTUS SUPERIOR, lifting the eye directly upwards, is named the MUSCULUS ATTOLLENS; the LEVATOR OCULI; or SUPERBUS, as expreſſive of haughtineſs and pride.

XXVI. And the RECTUS INFERIOR, which is directly oppoſite to it, is named DEPRIMENS OCULI; or HUMILIS, as expreſſing modeſty and ſubmiſſion.

XXVII. The RECTUS INTERNUS is called ADDUCENS, as carrying the eye towards the noſe; or BIBITORIUS, becauſe it directs the eye to the cup.

And (XXVIII.) the RECTUS EXTERNUS, the outer ſtraight muſcle, as it turns the eye away, is named ABDUCTOR OCULI, or INDIGNABUNDUS, expreſſing anger or ſcorn. Such is the effect of theſe muſcles, that when they act in ſucceſſion, they roll the eye; but if they act all at once, the power of each is balanced by the action of its oppoſite muſcle, and the eye is immovably fixed. So that ſometimes in our operations, when the couching needle approaches the eye, fear comes upon the patient, and the eye is fixed by a convulſive action, more firmly than it could be by the inſtruments, or by the finger; ſo that the ſpeculum oculi is after ſuch an accident of no uſe: The eye continues fixed during all the operation, but it is fixed in a moſt dangerous way, by a power which we cannot controul, and which ſometimes, when our operation is for extracting one of the humours only, ſqueezes out the whole.

XXIX. The OBLIQUUS SUPERIOR ariſes along with the recti in the bottom of the eye, above and towards the inner ſide; directing its long tendon towards the inner angle of the eye; and there it paſſes its tendon through that pulley, whoſe hollow I have marked in deſcribing the os frontis, as under the ſuperciliary ridge, and near to the inner corner of the eye. It ariſes by a ſmall tendon, like one of the recti; it goes over the upper part of the eyeball, a long and ſlender muſcle, whence it is often named LONGISSIMUS OCULI, the longeſt muſcle of the eye. It forms a ſmall ſmooth round tendon, which paſſes through the ring of the cartilaginous pulley, which is in the margin of the ſocket. The pulley is above the eye, and projects farther than the moſt prominent part of the eyeball, ſo that the tendon returns at an acute angle, and bends downwards before it can touch the eyeball. And it not only returns backwards in a direction oppoſite to the recti muſcles, but it ſlips flat under the body of the rectus ſuperior, and is ſpread out under it upon the middle, or behind the middle of the eye, viz. about half way betwixt the inſertion of the rectus and the entrance of the optic nerves.

XXX. The OBLIQUUS INFERIOR is, with equal propriety, named the MUSCULUS BREVISSIMUS OCULI. It is directly oppoſite to the obliquus ſuperior, in form, place, office, &c.; for it ariſes from the naſal proceſs of the jaw-bone, in the lower edge of the orbit, at the inner corner of the eye: it is ſhort, flat, and broad, with a ſtrong fleſhy belly: it goes obliquely backwards and outwards, lying under the ball of the eye; and it is inſerted broad and flat into the ball, exactly oppoſite to the inſertion of the obliquus ſuperior muſcle.

Theſe two muſcles roll the eye, whence they are named MUSCULI CIRCUMAGENTES, or AMATORII. But they have ſtill another important office, viz. ſupporting the eyeball, for the operation of its ſtraight muſcles; for when theſe (the obliqui) act, they pull the eye forwards; the ſtraight muſcles reſiſt; and the inſertion of the oblique muſcles at the middle of the eyeball becomes, as it were, a fixed point, a centre or axis round which the eyeball turns under the operation of the recti muſcles. The conjoined effect of the oblique muſcles is to bring the eyeball forwards from the ſocket, as in ſtraining the eye to ſee ſome diſtant point. The particular effect of the upper oblique muſcle is not to bring the eye forward, but to roll the eye ſo as to turn the pupil downwards, and towards the noſe. And the particular effect of the lower oblique muſcle is to reverſe this action, to turn the eye again upon its axis, and to direct the pupil upwards and outwards; but the ſucceſſive actions of all theſe muſcles move the eye in circles, with gradations ſo exquiſitely ſmall, and with ſuch curious combinations as cannot be explained by words.

CHAP. II.

MUSCLES OF THE LOWER JAW, THROAT, AND TONGUE.

MUSCLES OF THE LOWER JAW.

The lower jaw requires muſcles of great power to grind the food; and accordingly it is pulled upwards by the ſtrong temporal, maſſeter, and pterygoid muſcles. But in moving downwards, the jaw almoſt falls by its own weight; and having little reſiſtance to overcome, any regular appointment of muſcles for pulling down the jaw is ſo little needed, that it is pulled downwards by muſcles of ſuch ambiguous office, that they are equally employed in raiſing the throat, or pulling down the jaw, ſo that we hardly can determine to which they belong; for the chief muſcles of the throat, coming from the lower jaw, muſt, when the jaw is fixed, pull up the throat; or, when the throat is fixed, depreſs the jaw.

XXX. The TEMPORAL MUSCLE is the great muſcle of the jaw. It ariſes from all the flat ſide of the parietal bone, and from the ſphenoid, temporal, and frontal bones, in that hollow behind the eye where they meet to form the ſquamous ſuture. It ariſes alſo from the inner ſurface of that ſtrong tendinous membrane which is extended from the jugum to the ſemicircular ridge of the parietal bone. The fibres are bundled together and preſſed into a ſmall compaſs, ſo that they may paſs under the jugum; there they take a new hold upon the inner ſurface of the jugum, and the muſcle is of courſe pyramidal, its rays converging towards the jugum. Its muſcular fibres are intermixed with ſtrong tendinous ones; it is particularly tendinous where it paſſes under the jugum; and it has both ſtrength and protection from that tendinous plate which covers it in the temple. Its inſertion is into the horn of the lower jaw-bone; not merely into the tip of the horn, but embracing it all round, and down the whole length of the proceſs, ſo as to take the firmeſt hold.

XXXI. The MASSETER is a ſhort, thick, and fleſhy muſcle, which gives the rounding of the cheek at its back part. It ariſes from the upper jaw-bone, at the back of the antrum, and under the cheek-bone, and from the lower edge of the zygoma. It lies upon the outſide of the coronoid proceſs, covering the branch of the jaw quite down to its angle. It is particularly ſtrong; has many maſſy bundles of fleſh interſperſed with tendinous ſtrings; the parotid gland lies on its upper part, and the duct of the gland (as it croſſes the cheek) lies over this muſcle. The jaw is very firmly pulled up by theſe two, which are its moſt powerful muſcles; and when we bite, we can feel the temporal muſcle ſwelling on the flat part of the temple, and this the maſſeter upon the back part of the cheek.

XXXII. XXXIII. The two PTERYGOID MUSCLES (of which there are four in all, two on either ſide) are named from their origin in the pterygoid proceſſes of the ſphenoid bone. The PTERYGOIDEUS INTERNUS is that one which riſes from the internal or flatter pterygoid proceſs, and which goes downwards and outwards to the angle of the jaw on its inſide. The PTERYGOIDEUS EXTERNUS ariſes from the external pterygoid proceſs; and goes not downwards, but almoſt directly outwards, and is implanted high in the jaw-bone, juſt under its neck, and connected with its capſular ligament. Now the pterygoideus internus deſcending to be fixed to the angle of the jaw, is longer and bigger, and is named PTERYGOIDEUS MAJOR. The internal one going directly acroſs, and rather backwards, has leſs ſpace to traverſe, is ſhorter, and is named PTERYGOIDEUS MINOR.

The jaw is moved chiefly by theſe muſcles; the temporalis acting upon the coronoid proceſs like a lever; the maſſeter acting upon the angle, and before it; and the pterygoideus internus balancing it within, like an internal maſſeter fixed to the inſide of the angle. All theſe pull ſtrongly upwards for biting, holding, and tearing with the teeth. And the external or leſſer pterygoid muſcle going from within outwards, pulls the jaw from ſide to ſide, and performs all the motions of chewing and grinding, *i. e.* of rotation, ſo far as the lower jaw poſſeſſes that kind of motion.

MUSCLES OF THE THROAT AND TONGUE.

The MUSCLES of the THROAT and TONGUE cannot be underſtood without a previous acquaintance with certain cartilages and bones, which form the baſis of the throat and tongue, and the centre of thoſe motions which we have next to deſcribe.

The os HYOIDES is a ſmall bone reſembling, in ſhape at leaſt, the jaw-bone. It has a middle thicker part, named its baſis, which is eaſily felt outwardly; it correſponds in place with the chin, and is diſtinguiſhed about an inch below the chin; the uppermoſt of the hard points which are felt in the forepart of the throat. Next, it has two long horn-like proceſſes, which go backwards along the ſides of the throat, called the cornua, or horns of the os hyoides; and which are tied by a long ligament, which comes down from the ſtyloid proceſs of the temporal bone. And, laſtly, It has ſmall cartilaginous pieces or joinings, by which the horns are united to the baſis; and often in the adult this joining is converted into bone. At this point where the two horns go backwards, like the legs of the letter V, there are commonly at the griſtly part of the os hyoides two ſmall perpendicular proceſſes which ſtand up from the joining of the horns to the body; and theſe are named the appendices of the os hyoides or the leſſer cornua.

Now this os hyoides forms by its baſis the root of the tongue; thence it is often named the bone of the tongue. It forms at the ſame time the upper part of the trachea, or windpipe; and it carries upon it that cartilage named epiglottis, which, like a valve, prevents any thing getting down into the windpipe. Its horns extend along the ſides of the throat, keeping the openings of the windpipe and gullet extended as we would keep a bag extended by two fingers. The chief muſcles of the tongue and of the windpipe ariſe from its body; the chief muſcles of the gullet ariſe from its horns, and eſpecially from their points; it receives the chief muſcles which either raiſe or depreſs the throat; and it is the point d'appui, or fulcrum for all the muſcles of the throat and tongue, and the centre of all their motions. It is the centre of the motions of the tongue; for it is the origin of theſe muſcles which compoſe chiefly the bulk of the tongue; of the motions of the trachea or windpipe, for it forms at once the top of the windpipe, and the root of the tongue, and joins them together; of the motions of the pharynx or gullet, for its horns ſurround the upper part of the gullet, and join it to the windpipe; and it forms the centre for all the motions of the throat in general, for muſcles come down from the chin to the os hyoides, to move the whole throat upwards; others come up from the ſternum, to move the throat downwards; others come obliquely from the coracoid proceſs of the ſhoulder-blade, to move the throat backwards, while the os hyoides ſtill continues the centre of all theſe motions.

The TRACHEA, or WINDPIPE, is that tube which conveys the air to the lungs; and the LARYNX is the head, or figured part of that tube which is formed like a flute for the modulation of the voice, and conſiſts of cartilages, that it may ſtand firm and uncompreſſed, either by the paſſage of the food, or by the weight of the outward air; and that it may reſiſt the contraction of the ſurrounding parts, ſerving as a fulcrum for them in the motions of the jaw, tongue, and gullet. Its cartilages are, firſt, the SCUTIFORM, or THYROID cartilage, which is named from its reſemblance to a ſhield, or rather it is like the flood-gates or folding doors of a canal, the meeting of the two ſides being in the middle line of the throat. This prominent line of the thyroid cartilage is eaſily felt in the middle of the throat; is about an inch in length, and makes that tumour which is called the pomum Adami. The flat ſides of the thyroid cartilage form the ſides of the flute part of the trachea. And there are two long horns at its two upper corners, which riſe like hooks above the line of the cartilage, and are joined to the horns of the os hyoides; and two ſimilar, but ſhorter hooks below, by which it embraces the cricoid cartilage.

The CRICOID CARTILAGE is next to the thyroid, and below it; it is named from its reſemblance to a ring: It is indeed like a ring or hoop, but it is not a hoop equally deep in all its parts, it is ſhallow before, where it ekes out the length of the thyroid cartilage; and is deeper behind, where it forms the back of this flute-like top of the trachea; it is the top ring of the trachea, and the lower ring of the larynx or flute part of the windpipe. And upon its back, or deeper part, are ſeated thoſe two ſmall cartilages, which form the opening for the breath.

The ARYTENOID CARTILAGES are two ſmall bodies, of the ſize of peaſe. They are fooliſhly deſcribed with cornua, ridges, and ſurfaces, when they are ſo ſmall that nothing further can be obſerved of their forms than that they are ſomewhat triangular; that the baſe or broad part of each ſits down upon the upper edge of the cricoid cartilage at its back; that the point of each ſtands directly upwards, and is a very little crooked, or hook-like, that ſtanding, as they do, a little apart from each other, they form together an opening ſomething like the ſpout of a ewer, or ſtrouped baſon, whence their name. And theſe cartilages being covered with the common membrane of the throat, which is thick, and full of mucous glands, the opening gets a regular appearance with rounded lips; and this opening, or ſlit between them, which is ſomething like the ſlit for the thill in the top of a counter, and which ſlaunts obliquely downwards, is named the RIMA GLOTTIDIS, or chink of the glottis; and theſe cartilages being fixed on the cricoid cartilage by a regular hinge, they form the voice by their nearneſs and the narrowneſs of the ſlit; and modify it by their motions, which are ſo exquiſitely minute, that for every changing of the note (and there are ſome thouſand gradations in the compaſs of the voice), they move in a proportioned degree.

The EPIGLOTTIS is a fifth cartilage of the trachea, belonging to it both by connection and by office. It is a broad triangular cartilage, not ſo hard as the others, very elaſtic, and ſo exactly like an artichoke leaf, that no other figure can repreſent it ſo well. Its office is to defend the opening of the glottis. It is fixed at once to the os hyoides, to the thyroid cartilage, and to the root of the tongue, and it hangs obliquely backwards over the opening of the rima, or chink, of the glottis; it is ſuſpended by little peaks of the membrane, which we call ligaments of the glottis, and it is ſaid to be raiſed or depreſſed by muſcles, which yet are not very fairly deſcribed. But the rolling of the morſel which is ſwallowed, and the motion of the tongue, are ſufficient to lay it flat over the rima, ſo that it is a perfect guard.

Then this is the conſtitution of the larynx. It is of hard cartilages to reſiſt compreſſion, and of a flute form at its opening, to regulate the voice. The THYROID cartilage is the great one, the chief defence before, and which has edges ſlanting far backwards, to defend the opening of the larynx. The CRICOID cartilage, which forms the upper ring of the trachea, ſupports the arytenoid cartilages, and by its deepneſs behind, raiſes them ſo that the opening of the glottis is behind the middle of the great thyroid cartilage, and in the deepeſt part of it, well defended by its projecting wings. The ARYTENOID cartilages form the rima glottidis, the chink by which we breathe (which, as it is narrower or wider, modulates and tunes the voice), the opening which is ſo exquiſitely moved by its muſcles in ſinging; widening or contracting in moſt delicate degrees; and which is ſo ſpaſmodically ſhut by the ſame muſcles when it is touched by a drop of water, or by a crumb of bread: but the valve of the glottis, the EPIGLOTTIS ſtanding over it, flaps down like the key of a wind inſtrument, ſo that the rareneſs of ſuch accidents is wonderful, when we conſider that the leaſt attempt to draw the breath, while we are ſwallowing, will produce the accident.

The muſcles which move the tongue and throat muſt be far too complicated to be explained at all, without ſome previous knowledge of theſe parts; and ſtill, I fear, not eaſily to be explained with every help of regularity and order.

MUSCLES OF THE THROAT.

By this arrangement, I mean to include under one claſs all thoſe muſcles which move the os hyoides, or the larynx; and through theſe, as centrical points, the jaws, gullet, and tongue; and which, though they are inſerted into the larynx, have more relation to ſwallowing, or the motions of the gullet, than to breathing, or to the motions of the windpipe.

The muſcles which pull the throat down are theſe:

XXXIV. The STERNO-HYOIDEUS, which paſſes from the ſternum to the os hyoides; a flat broad riband-like muſcle, which ariſes from the upper piece of the ſternum, rather within the breaſt; and partly alſo from the clavicle and cartilage of the firſt rib; goes flat and ſmooth along the forepart of the throat; mounts, nearly of the ſame breadth, to the os hyoides; and is implanted into its baſis, or that part (which in reſembling the os hyoides to the jaw) we ſhould compare with the chin.

XXXV. The STERNO-THYROIDEUS, which paſſes in like manner from the ſternum to the thyroid cartilage, is like the laſt, a flat ſmooth riband-like muſcle; rather thicker and more fleſhy, but very uniform in its thickneſs. As the thyroid cartilage is below the os hyoides, the ſterno-thyroid muſcle muſt lie under the ſterno-hyoideus muſcle. It ariſes under the ſterno-hyoideus muſcle from the ſternum and cartilage of the rib; and is implanted into the rough line of the lower edge of the thyroid cartilage, and a little to one ſide, but not ſo much as is repreſented in Cowper's drawings. It immediately covers the thyroid gland; and the way to the trachea for piercing it in performing bronchotomy is in the middle betwixt theſe muſcles.

XXXVI. The OMO-HYOIDEUS, which was once named CORACO-HYOIDEUS being thought to ariſe from the coracoid proceſs. It is a muſcle of great length, and very ſlender, reaching from the ſhoulder to the os hyoides; it is like theſe laſt mentioned, a long flat, ſtrap-like muſcle; as flat and as fleſhy, but not ſo broad, as either of the former. It lies along the ſide of the neck; is pinched in a little in the middle, where it is divided by a tendinous croſs line, which ſeparates the fleſhy belly into two heads. It ariſes from the upper edge of the ſcapula, near its notch, and is implanted into the ſide of the os hyoides, where the horn goes off from the body of the bone.

Theſe three muſcles pull the throat down. The ſterno-hyoideus and ſterno-thyroideus pull it directly downwards: one of the omo-hyoidei acting, pulls it to one ſide; but if both act, they aſſiſt in pulling directly down, and they brace the trachea at the ſame time a little down to the back.

The muſcles which move the throat upward, are:

XXXVII. The MYLO-HYOIDEUS, a flat and broad muſcle, which ariſes from the whole ſemicircle of the lower jaw, *i. e.* from the backmoſt grinders to the point of the chin. It riſes from the inner ſurface of the jaw-bone; goes down to the baſis of the os hyoides; proceeds with very regular, ſtraight, clear, and orderly fibres, from the jaw to the os hyoides; is plainly divided in the middle from the ſymphyſis of the jaw to the middle of the os hyoides, by a middle tendinous and white line. And though Cowper denies the authority of Veſalius, who divides it thus, it is plainly two diſtinct muſcles, one belonging to either ſide.

XXXVII. The GENIO-HYOIDEUS is a ſmall neat pair of muſcles ariſing from the chin at a rough point, which is eaſily diſtinguiſhed within the circle of the jaw. The

mylo-

mylo-hyoideus is named from the whole jaw. The genio-hyoideus is named from the chin, ariſing from a ſmall tubercle behind the chin; its beginning is exceedingly narrow: as it proceeds downwards, it grows flat and broad; it is implanted into the baſis of the os hyoides by a broad edge, and is a beautiful and radiated muſcle. The ſublingual gland lies flat betwixt this muſcle and the laſt; and in the middle the ſublingual duct pierces the membrane of the mouth, to open under the root of the tongue. The two muſcles move the os hyoides forwards and upwards, when the jaw is fixed; but when the os hyoides is fixed by the muſcles coming from the ſternum, theſe muſcles of the os hyoides pull the jaw down.

XXXIX. The STYLO-HYOIDEUS is one of three beautiful and ſlender muſcles, which come from round the ſtyloid proceſs; which all begin and end with ſlender tendons, and with ſmall fleſhy bellies; and one going to the pharynx or gullet, another to the os hyoides, and a third to the tongue, they coincide in one common action of drawing back the tongue, and pulling the throat upwards.

This one, the ſtylo-hyoideus, ariſes from about the middle of the ſtyloid proceſs, and going obliquely downwards and forwards, is fixed into the ſide of the os hyoides, where the baſis and horn are joined. Above its inſertion, its fibres are ſplit, ſo as to make a neat ſmall loop, through which the tendon of the digaſtric muſcle runs. This ſtylo-hyoideus is ſometimes accompanied with another ſmall fleſhy muſcle like it, and of the ſame name; which was firſt perhaps obſerved by Cowper, and has been named by Innes

STYLO-HYOIDEUS ALTER; but it is not regular, nor has it ever been acknowledged as a diſtinct muſcle.

XL. The DIGASTRICUS, or BIVENTER MAXILLÆ INFERIORIS, is named from its having two bellies. One belly ariſes from a rugged notch along the root of the maſtoid proceſs, where the fleſh is thick and ſtrong; going obliquely forwards and downwards, it forms a long tendon, round, thick, and very ſtrong, which paſſes by the ſide of the os hyoides; and as it paſſes, it firſt ſlips through the loop or nooſe of the ſtylo-hyoideus, and then is fixed by a tendinous bridle to the ſide of the os hyoides; and then turning upwards towards the chin, it ends in a ſecond fleſhy belly, which, like the firſt, is flat, and of a pyramidal ſhape, lying above the mylo-hyoideus.

Though this muſcle is often called biventer maxillæ inferioris, as belonging to the lower jaw, perhaps it does more regularly belong to the throat. No doubt, when the os hyoides is fixed by its own muſcles from the ſhoulder and ſternum, the digaſtricus muſt act on the jaw; an office which we cannot doubt, ſince we often feel it taking a ſudden ſpaſm, pulling down the chin with ſevere pain and diſtortion of the neck. But its chief office is to raiſe the os hyoides; for when the jaw is fixed, as in ſwallowing, the raiſing of the os hyoides pulls up the throat; and this is the true meaning of its paſſing through the nooſe of the ſtylo-hyoideus, and of its connection with the ſide of the os hyoides. Then the digaſtric and ſtylo-hyoideus muſcles pull the throat upwards and backwards.

The muſcles which move the parts of the larynx upon each other are much ſmaller, and many of them very minute.

XLI. The HYO-THYROIDEUS goes down, fleſhy and ſhort, from the os hyoides, to the thyroid cartilage. It ariſes from the lower border of the thyroid cartilage, where the ſterno-thyroideus terminates, and goes up along the ſide of the thyroid cartilage, like a continuation of the ſterno-thyroideus muſcles. It paſſes the upper border of the thyroid cartilage, and is fixed to the lower edge of the os hyoides, along both its baſe and part of its horn.

XLII. The CRICO-THYROIDEUS is a very ſhort muſcle, paſſing from the upper edge of the cricoid to the lower margin of the thyroid cartilage, chiefly at its ſide, and partly attached to its lower horn; which comes down claſping the ſide of the CRICOID ring, ſo that it is broader above, and a little pointed below.

Theſe two ſmall muſcles muſt have their uſe, and they bring the thyroid cartilage nearer to the os hyoides, and the cricoid nearer to the thyroid cartilage; and by thus ſhortening the trachea, or compreſſing it ſlightly, they may perhaps affect the voice. But the muſcles on which the voice chiefly depends, are thoſe of the RIMA GLOTTIDIS; for there is a double ſet of muſcles for the little arytenoid cartilages; one ſet which brings the cartilages together, and another ſet which draws them apart, and ſpreads the opening of the larynx.

XLIII. The MUSCULUS ARYTENOIDEUS TRANSVERSUS is that delicate muſcle which contracts the glottis, by drawing the arytenoid cartilages towards each other. It lies acroſs, betwixt them, at their back part; it ariſes from the whole length of one arytenoid cartilage to go acroſs, and be inſerted into the whole length of the oppoſite one.

XLIV. ARYTENOIDEUS OBLIQUUS, is one which croſſes in a more oblique direction, ariſing at the root of each arytenoid cartilage, and going obliquely upwards to the point of the oppoſite one. Theſe two muſcles draw the arytenoid cartilages together, and cloſe the RIMA.

XLV. The CRICO ARYTENOIDEUS POSTICUS, is a ſmall pyramidal muſcle, which ariſes broader from the back part of the cricoid cartilage, where the ring is broad and deep; and going directly upwards, is implanted with a narrow point into the back of the arytenoid cartilage. This pair of muſcles pulls the arytenoid cartilages directly backwards, and lengthens the ſlit of the glottis.

XLVI. The CRICO ARYTENOIDEUS OBLIQUUS, is one which comes from the ſides of the cricoid cartilage, where it lies under the wing of the thyroid, and being implanted into the ſides of the arytenoid cartilages, near their roots, muſt pull theſe cartilages aſunder, and (as the origin in the cricoid lies rather before their inſertion in the arytenoid cartilages) it muſt alſo ſlacken the lips of the ſlit; for the lips of the ſlit are formed by two cords, which go within the covering membrane, from the tip of each cartilage to the back of the thyroid cartilage; and the crico arytenoideus poſticus muſt ſtrengthen theſe cords, and the crico arytenoideus lateralis muſt relax them.

XLVII. The THYREO ARYTENOIDEUS, is a muſcle very like the laſt one, and aſſiſts it. It ariſes not from the

the cricoid cartilage, but from the back ſurface of the wing of the thyroid; from the hollow of its wing, or where it covers the cricoid; is implanted into the fore part of the arytenoid cartilage, and by pulling the cartilage forward and ſidewiſe, directly ſlackens the ligaments and widens the glòttis.

Theſe are all the muſcles which belong to the larynx; and in our arrangement the muſcles of the PALATE and PHARYNX come next in order.

When a morſel is to be thrown down into the œſophagus, or tube which leads to the ſtomach, the VELUM PALATI, or curtain of the palate, is drawn upwards; the opening of the throat is ditated; the morſel is received; then the curtain of the palate falls down again. The arch of the throat is contracted, the bag of the pharynx is compreſſed by is own muſcles; and the food is forced downwards into the ſtomach.

XLVIII. The AZYGOS UVULÆ.—The VELUM PENDULUM PALATI, is that pendulous curtain which we ſee hanging in the back part of the mouth, in a line with the ſide circles of the throat; and the uvula is a ſmall pap, or point of fleſh, in the centre of that curtain. The AZYGOS UVULÆ, or ſingle muſcle of the uvula, is a ſmall ſlip of ſtraight fibres, which goes directly down to the uvula in the centre of the curtain. It ariſes from the peak, or backmoſt ſharp point of the palate bones, and pulls the uvula, or pap of the throat, directly upwards, removing it out of the way of the morſel which is to paſs.

XLIX. LEVATOR PALATI MOLLIS ariſes from the point of the os petroſum, and from the EUSTACHIAN tube, and alſo from the ſphenoid bone*. Theſe parts hang over the roof of the velum, and are much higher than it; ſo this muſcle deſcends to the velum, and ſpreads out in it; and its office is to pull up the velum, to remove it from being in the way of the morſel, which is about to paſs, and to lay the curtain back at the ſame time, ſo as to be a valve for the noſtrils, and for the mouth of the euſtachian tube, hindering the food or drink from entering into theſe paſſages.

L. The CIRCUMFLEXUS PALATI †, and the CONSTRICTOR ISTHMI FAUSCIUM, have a very different uſe. The circumflexus palati is named from its fibres paſſing over, or rather under, the hook of the PTERYGOID proceſs; the muſcle ariſes along with the levator palati (i. e.) from the ſphenoid bone at its ſpinous proceſs; and from the beginning of the euſtachian tube, it runs down along the tube, in the hollow betwixt the pterygoid proceſſes; it then becomes tendinous, turns under the hook of the internal pterygoid proceſs, and mounts again to the ſide of the velum. Now, the levator and circumflexus ariſe from the ſame points;

but

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* From the euſtachian tube, it was named SALPINGO-STAPHILINUS; from the ſphenoid bone, SPHENO-STAPHILINUS; from the pterygoid proceſs, PTERYGO-STAPHILINUS; from the petrous proceſs, it was named PETRO-SALPINGO-STAPHILINUS; as if there were no ſcience but where there were hard names, and as if the chief mark of genius were enriching the hardeſt names, with all poſſible combinations and contortions of them.

† This alſo has got a tolerable aſſortment of hard names; as CIRCUMFLEXUS PALATI, TENSOR PALATI, PALATO-SALPINGUS, STAPHILINUS EXTERNUS, SPHENO-SALPINGO-STAPHILINUS, MUSCULUS, TUBÆ, viz. EUSTACHIANÆ NONUS. PTERYGO-STAPHILINUS of Cowper, &c.

but the levator goes directly downwards into the velum, and ſo is uſeful in lifting it up. The circumflexus goes round the hook; runs on it as on a pully; turns upwards again; and ſo it pulls down the palate, and ſtretches it; and thence is very commonly named, the TENSOR PALATI MOLLIS, or ſtretcher of the palate.

LI. The CONSTRICTOR ISTHMI FAUSCIUM, ariſes from the very root of the tongue on each ſide; goes round to the middle of the velum, and ends near the uvula*. This ſemicircle forms that firſt arch which preſents itſelf upon looking into the mouth.

LII. The PALATO-PHARYNGEUS†, again, forms a ſecond arch behind the firſt; for it begins in the middle of the ſoft palate; goes round the entry of the fauces, ends in the wing or edge of the thyroid cartilage; and as the firſt arched line (that formed by the conſtrictor) belonged to the root of the tongue, this ſecond arched line belongs to the pharynx or gullet. The circumflexus palati makes the curtain of the palate tenſe, and pulls it downwards: The conſtrictor fauſcium helps to pull down the curtain, and raiſes the root of the tongue to meet it: The palato-pharyngeus farther contracts the arch of the fauces, which is almoſt ſhut upon the morſel now ready to be forced down into the ſtomach, by thoſe muſcles which compreſs the pharynx itſelf.

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* Named GLOSSO-STAPHILINUS, from its origin in the tongue, and inſertion into the UVULA.

† The SALPINGO-PHARYNGEUS of Albinus, is no more than that part of the palato-pharyngeus which ariſes from the mouth of the euſtachian tube.

The PHARYNX, which is the opening of the gullet, that it may receive freely the morſel of food, is expanded into a large and capacious bag, which hangs from the baſis of the ſkull, is chiefly attached to the occipital bone, the pterygoid proceſſes, and the back parts of either jaw-bone. The œſophagus, again, is the tube which conveys the food down into the ſtomach; and this bag of the pharynx is the expanded or trumpet-like end of it; or it may be compared with the mouth of a funnel. Towards the mouth, the pharynx is bounded by the root of the tongue and by the arches of the throat; behind, it lies flat and ſmooth along the bodies of the vertebræ; before, it is protected, and in ſome degree ſurrounded, by the great cartilages of the larynx; the horns of the os hyoides embrace its ſides, and it is covered with flat muſcular fibres, which, ariſing from the os hyoides and cartilages of the throat, go round the pharynx, in fair and regular orders, and are named its conſtrictors, becauſe they embrace it cloſely, and their contractions force down the food.

LIII. The STYLO-PHARYNGEUS, ariſes from the root of the ſtyloid proceſs. It is a long, ſlender, and beautiful muſcle; it expands fleſhy upon the ſide of the pharynx; extends ſo far as to take a hold upon the edge of the thyroid cartilage; it lifts the pharynx up to receive the morſel, and then ſtraitens and compreſſes the bag, to puſh the morſel down, and by its hold upon the thyroid cartilage it commands the larynx alſo, and the whole throat.

The pharynx being ſurrounded by many irregular points of bone, its circular fibres or conſtrictors have many irregular origins. The conſtrictor might fairly enough be explained as one muſcle, but the irregular origins ſplit the fibres of the muſcle, and give occaſion of dividing the conſtrictor into diſtinct parts; for one bundle ariſing from the occipital bone and os petroſum from the tongue, the pterygoid proceſs, and the two jaw bones, is diſtinguiſhed as one muſcle, the conſtrictor ſuperior [*]. Another bundle ariſing from the os hyoides, is named the conſtrictor medius [†]. A third bundle, the loweſt of the three, ariſing from the thyroid and cricoid cartilages, is named the conſtrictor inferior [‡].

LIV. The CONSTRICTOR SUPERIOR, ariſing from the baſis of the ſkull, from the jaws, from the palate, and from the root of the tongue, ſurrounds the upper part of the pharynx; and it is not one circular muſcle, but two muſcles divided in the middle line behind, by a diſtinct rapha, ſeam, or meeting of the oppoſite fibres.

LV. The CONSTRICTOR MEDIUS riſes chiefly from the round point in which the os hyoides terminates; it alſo ariſes from the cartilage of the os hyoides (i. e.) where the horns are joined to the body. The tip of the horn being the moſt prominent point, and the centre of this muſcle, it goes upwards and downwards, ſo as to have ſomething of a lozenge-like ſhape; it lies over the upper conſtrictor like a ſecond layer; its uppermoſt peak or pointed part touches the occipital bone, and its lower point is hidden by the next muſcle.

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[*] Theſe good opportunities of names have not been diſregarded: this muſcle has been named CEPHALO-PHARYNGEUS, PTERIGO-PHARYNGEUS, MYLO-PHARYNGEUS, GLOSSO-PHARYNGEUS.

[†] This one is named HYO-PHARYNGEUS, or SYNDESMO-PHARYNGEUS, from its origin in the cartilage alſo of the os hyoides.

[‡] This, of courſe, is named THYRO-PHARYNGEUS, and CRICO-PHARYNGEUS.

LVI. The CONSTRICTOR INFERIOR ariſes partly from the thyroid, and partly from the cricoid cartilage; and it again goes alſo obliquely, ſo as to overlap or cover the lower part of the conſtrictor medius. This, like the other two conſtrictors, meets its fellow in a tendinous middle line; and ſo the morſel admitted into the pharynx by the dilatation of its arches, is puſhed down into the œſophagus by the forces of theſe conſtrictores pharyngis, aſſiſted by its ſtyloid muſcles.

LVII. The OESOPHAGUS is merely the continuation of the ſame tube. It lies flat upon the back-bone, and it is covered in its whole length by a muſcular coat, which is formed, not like this of the pharynx, of circular fibres, but of fibres running according to its length chiefly. And this muſcle ſurrounding the membraneous tube of the œſophagus like a ſheath, is named VAGINALIS GULÆ.

MUSCLES OF THE TONGUE.

THE muſcles of the tongue are large bundles of fleſh which come from the os hyoides, the chin, and the ſtyloid proceſs. Their thickneſs conſtitutes the chief bulk of the tongue. Their actions perform all its motions. The muſcles, which I am now to deſcribe, form the whole fleſh of the tongue, excepting merely the thin membranes which cover the tongue, and give it form, and conduct its nerves to the papillæ or feeling points.

LVIII. The firſt muſcle of the tongue is the STYLO-GLOSSUS, which ariſes from the ſtyloid proceſs, goes obliquely downwards and forwards; it touches the tongue a little before the angle of the tongue; it makes part of the fleſh at the ſide of the tongue, expanding into its ſubſtance in ſomewhat of a radiated form; its office is, to pull the tongue backwards into the mouth.

LIX. The HYO-GLOSSUS is a comprehenſive name for all thoſe muſcles which ariſe from the os hyoides. The muſcles from the os hyoides go off in three faſciculi, and were once reckoned as diſtinct muſcles. That the portion which ariſes from the baſis of the os hyoides, was called BASIO-GLOSSUS; that which ariſes from the cartilaginous joining of the body and horn, was called CHONDRO-GLOSSUS; and that which ariſes from the horn itſelf, was named CERATO-GLOSSUS; or the terms were all bundled together into the perplexed names of BASIO-CHONDRO-CERATO-GLOSSUS.

The hyo-gloſſus, then, is all that muſcular fleſh which ariſes from the whole length of the os hyoides; and which, by the changing form of the bone in its baſis, cartilage, and horn, has ſlight marks of diviſion, but which lies all in one plain, and need not have diſtinct names.

LX. The GENIO-GLOSSUS ariſes from the rough tubercle behind the ſymphyſis of the chin. It has a very narrow or pointed origin; it ſpreads out fan-like, as it goes towards the tongue; and it ſpreads with radii, both forwards and backwards, making the chief part of the ſubſtance of the tongue.

LXI. The LINGUALIS is an irregular bundle of fibres which runs according to the length of the tongue: it lies betwixt the ſtylo-gloſſus and the genio-gloſſus; and as it is in the centre, and unconnected with any bone, it is named lingualis, as ariſing in the tongue itſelf.

The genio-gloſſi muſcles form by far the larger part of the tongue, and lie in the very centre. They go through the whole length (i. e.), from the root to the tip of the tongue; and from the radiated form of their fibres, they perform every poſſible motion; whence this was named by Winſlow, MUSCULUS POLYCHRESTUS, for its rays proceed from one point or centre, and thoſe which go to the point of the tongue pull the tongue backwards into the mouth; thoſe which go backwards, thruſt the tongue out of the mouth; the middle fibres acting, make the back of the tongue hollow, while the tip and the root of the tongue both riſe.

The hyo-gloſſi muſcles lie on either ſide of the genio-hyoidæi, and make up the ſides of the tongue; and their chief action would ſeem to be this, that the hyo-gloſſus muſcle of either ſide acting, the edges of the tongue would be pulled downwards, and the back rounded; the oppoſite of which motion is the genio-hyoidæi acting, by which the middle of the tongue is made into a groove; the edges riſing, and the centre being depreſſed. Laſtly, The ſtylo-gloſſus is plainly intended for drawing the tongue deep into the mouth, particularly affecting the point of the tongue.

CHAP. III.

OF THE MUSCLES OF THE ARM,

INCLUDING THE MUSCLES OF THE SCAPULA, ARM, FORE-ARM, AND HAND.

MUSCLES OF THE SCAPULA.

THE great peculiarity of the arm is the manner of its connection with the breaſt; to which it is fixed by no ligaments, nor joined to no bone, but is at once both fixed and moved by its ſtrong and numerous muſcles, which are indeed its only ligaments. Though it were perhaps more regular to deſcribe firſt the muſcles of the trunk, it will be more eaſy and natural to deſcribe firſt the broad muſcles belonging to the ſcapula, which cover almoſt the whole trunk, and hide its proper muſcles, viz. thoſe which move the ribs and ſpine. For the muſcles which move the ſcapula lie upon the trunk; thoſe which move the arm lie upon the ſcapula; thoſe which move the fore-arm lie upon the arm; and thoſe for moving the hand and fingers lie upon the fore-arm. The leg requires but one chief motion, viz. backwards and forwards, flexion and extenſion: It has no other motions than thoſe of the thigh and of the knee. But the arm requires an eaſy and circular motion; and its joints are multiplied; for it has the wriſt turning round; it has the elbow for hinge-like motions; it has the ſhoulder-joint upon which the arm rolls; and to aſſiſt all theſe, the ſcapula, which is the centre of all theſe motions, is itſelf moveable; after a certain point of elevation all the motion in raiſing the arm is performed, not by the motions of the ſhoulder-bone upon the ſcapula, but by the ſcapula upon the trunk. For whenever the ſhoulder-bone riſes to the horizontal direction, it is checked by the acromion, which hangs over it; and if the arm is to be raiſed higher ſtill, the ſcapula muſt roll; for it turns as if upon an axis paſſed through it, and in turning it glides upon thoſe muſcles, which are like a cuſhion betwixt it and the trunk.

The muſcles which move the ſcapula come from the breaſt to move it forwards; from the neck, to move it upwards; from the ſpines of the vertebræ, to move it backwards; and from the ſide, that is, from the ribs, to move it downwards.

LXII. The TRAPEZIUS is named from its lozenge form; or is often named CUCULARIS, from its reſembling the Monk's cowl; hanging back upon the neck. It is one of the moſt beautiful muſcles in the body; and the two muſcles together cover all the ſhoulders and neck, with a lozenge-like form, with neat and ſharp points, extending from the tip of one ſhoulder to the tip of the other, and from the nape of the neck quite down to the loins. It ariſes firſt by a ſtrong tendon from the moſt pointed part of the occipital bone, and along the tranſverſe ſpine quite to the maſtoid proceſs; from this point all down the neck it has no hold of the vertebræ, but ariſes from its fellow in a ſtrong tendon, which, extending like a bow-ſtring down the neck, over the arch of the neck, and not touching the vertebræ till it comes down to the top of the back, is named LIGAMENTUM NUCHÆ. The tendon begins again to take hold of the ſpines of the two laſt vertebræ of the neck, and ariſes from all the ſpinous proceſſes of the back downwards; from this long origin, its fibres converge, as it were, into one point, the tip of the ſhoulder: it alſo comes a little forward over the ſide of the neck.

It is implanted into one-third of the clavicle neareſt the ſhoulder; into the tip of the acromion; into the whole length of the ſpine, from which the acromion riſes. And its fibres, ariſing from along the neck and back, and converging almoſt into a point, muſt have various effects, according to the different fibres which act: for thoſe which come downwards muſt raiſe the ſcapula; thoſe which come from the middle of the back muſt carry it directly backwards; thoſe which come from the lower part of the back muſt depreſs it; and thoſe different fibres acting in ſucceſſion, muſt make the ſcapula roll. The trapezius is chiefly a muſcle of the ſcapula, but it muſt be alſo occaſionally a muſcle of the head, pulling the head backwards, and bending the neck.

Three other muſcles which raiſe the ſcapula, or carry it backwards, lie ſo much in the ſame plane, and are ſo little divided from each other, that they might almoſt be reckoned different portions of the ſame.

LXIII. LEVATOR SCAPULÆ, named alſo LEVATOR PROPRIUS ANGULARIS, is a ſmall thin ſlip of fleſh, which ariſes from the four or five uppermoſt vertebræ of the neck, at their tranſverſe proceſſes, by three or four, and ſometimes five, diſtinct heads. The heads join to form a thin and flat ſtripe of muſcle, about three inches in breadth, which is fixed by a flat thin tendon to the upper corner of the ſcapula, to pull it upwards, as in ſhrugging the ſhoulders; whence it is named MUSCULUS PATIENTIÆ.

LXIV. and LXV. The RHOMBOID MUSCLE ſtretches flat, neat, and of a ſquare form, betwixt the ſpine and the whole line of the baſe of the ſcapula. One part ariſes from the three lower ſpinous proceſſes of the neck, and is implanted into the baſe of the ſcapula at its upper part: then another portion ariſes from the ſpinous proceſſes of the firſt four vertebræ of the back; runs exactly in the ſame plane with the other into the baſe of the ſcapula at its lower part: the part ariſing from the three vertebræ of the neck is ſlightly divided from that which ariſes from the four vertebræ of the back, though not diſtinctly, and often not at all. I would reckon this but one muſcle, but it has been commonly diſtinguiſhed into (LXIV.) the RHOMBOIDES MINOR, the uppermoſt portion, and (LXV.) the RHOMBOIDES MAJOR, the lower portion. Theſe are ſeen after raiſing the trapezius; and the uſes of the trapezius, levator ſcapulæ, and rhomboides, are to raiſe the ſcapula, or to carry it backwards. The muſcles which move the ſcapula downwards and forwards, viz. the pectoralis minor and the ſerratus major anticus, lie upon the fore-part of the breaſt.

LXVI. The SERRATUS MAJOR ANTICUS lies upon the ſide of the cheſt ariſing from the ribs; and as the ribs have interſtices betwixt them, every muſcle ariſing from the ribs ariſes by diſtinct portions from each rib. All ſuch diſtinct and pointed ſlips are named digitations, tongues, or ſerræ, from their reſembling the teeth of a ſaw; and every muſcle ariſing from the ribs muſt be a ſerrated muſcle. The ſerratus major anticus is that great and broad muſcle, the chief part of which lies under the ſcapula; and nothing of which is ſeen but the fleſhy tongues, by which it ariſes from the ſides of the ribs. It is all fleſhy, and is of a conſiderable breadth and ſtrength: it ariſes from all the true ribs, except the firſt, and from three of the falſe ribs: its indigitations, of courſe, ſpread all over the ſide of the thorax like a fan: its upper indigitations lie under the pectoralis major, and its lower indigitations are mixed with the beginning of the abdominal muſcles: its middle indigitations are ſeen ſpreading upon the ſides of the thorax: it lies thick and fleſhy under the ſcapula, and is a part of that cuſhion on which the ſcapula glides: its fibres converge towards a narrower inſertion; and the muſcle ends thick and fleſhy in the whole length of that line which we call the baſis of the ſcapula, and is, as it were, folded round it; ſo that this muſcle, which comes from before, is implanted along with the rhomboides, which comes from behind.

Perhaps, in difficult breathing, the ſhoulder blade being raiſed and fixed by its own muſcles, the ſerratus major may aſſiſt in heaving up the ribs: but its chief operation is upon the ſcapula; for when the whole acts, it pulls the ſcapula downwards and forwards: when only the lower portions act, it pulls the lower angle of the ſcapula forwards, by which the ſcapula rolls, and the tip of the ſhoulder is raiſed: when the upper part acts in conjunction with the little pectoral muſcle, the tip of the ſhoulder is fixed and pulled downwards towards the cheſt, and the lower corner of the ſcapula rolls backwards.

LXVII. The PECTORALIS MINOR lies under the pectoralis major, cloſe upon the ribs; and as it ariſes from the third, fourth, and fifth ribs, it alſo is a ſerrated muſcle, and was named ſerratus minor anticus: its three digitations are very thick and fleſhy; they ſoon converge ſo as to form a ſmall, but thick and fleſhy, muſcle, which, terminating in a point, is inſerted into the very apex of the coracoid proceſs: by pulling the coracoid proceſs forwards and downwards, it will roll the ſcapula.

LXVIII. The SUBCLAVIAN MUSCLE is another concealed muſcle of the ſcapula; for the clavicle is juſt the hinge upon which the ſcapula moves, and the ſubclavian muſcle ariſes by a flat tendon from the cartilage of the firſt rib: it becomes flat and fleſhy, and lies along betwixt the clavicle and the firſt rib; it ariſes at a ſingle point of the rib, flat and tendinous; but it is inſerted into a great length of the clavicle, beginning about one inch from the ſternum, and being inſerted all along the clavicle, quite out to where it is joined to the acromion proceſs. Its chief uſe (ſince the rib is immoveable) muſt ſurely be to pull the clavicle,

vicle, and conſequently the ſhoulder, downwards, and ſo to fix them.

Many have affected to find other muſcles of reſpiration than thoſe which directly belong to the ribs. Among theſe are reckoned the ſerratus major, the pectoralis minor, &c.; but there is much reaſon to doubt whether any muſcles can have much effect which do not belong properly to the ribs: and it is manifeſt, that the ſubclavian can have none, ſince the firſt rib is quite rigid, has ſo little length of cartilage that it cannot bend nor move.

The ſcapula is thus moved in every poſſible direction; upwards, by the levator and the trapezius; backwards, by the rhomboides, aſſiſted by other orders of the trapezius; downwards and backwards, by the loweſt order of fibres in the trapezius; downwards and forwards, by the ſerratus major anticus; directly downwards, by the ſerratus, balanced by the trapezius, and aſſiſted by the ſubclavius; and directly forwards, by the pectoralis minor.

MUSCLES OF THE ARM,

VIZ. THOSE MOVING THE OS HUMERI, OR ARM BONE.

LXIX. The PECTORALIS MAJOR is a large thick and fleſhy muſcle which covers all the breaſt. It ariſes from two-thirds of the clavicle next the ſternum; from all the edges of the ſternum; the cartilaginous endings of the fifth and ſixth ribs. Where it ariſes from the ſternum, it is tendinous, and the fibres from the oppoſite muſcles croſs and mix, ſo as to make a ſort of faſcia covering the bone. It is fleſhy where it ariſes from the ribs, and there it mixes with the external abdominal muſcle. The fibres approach each other till they form a flat tendon about an inch in breadth ; and as the fibres approach each other, they croſs in ſuch a way, that the lower edge of the muſcle forms the upper edge of the tendon, which is ſtill flat, but twiſted: its implantation is into the edge, if I may call it ſo, of the groove or rut which is in the ſhoulder bone for receiving the biceps tendon. That part which ariſes from the clavicle is a little ſeparated from that which ariſes from the ſternum ; a fatty line makes the diſtinction ; and they are ſometimes deſcribed as two parts : it is thoſe two bundles chiefly which croſs each other to make the plaited appearance. The pectoralis, among others, has been made a muſcle of reſpiration *.

LXX. The LATISSIMUS DORSI is the broadeſt, not only of the back, but perhaps of the whole body. It is a beautiful muſcle, covering all the lower part of the back and loins, and reaching to the arm, to be the antagoniſt to the pectoral muſcle. It ariſes by a broad, flat, and gliſtening tendon, which covers all the loins, and which is in ſome degree the root of other muſcles, eſpecially of the longiſſimus dorſi. This broad ſilvery tendon, begins exactly in the middle of the back ;

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* Haller tells us, that when, at any time, he had rheumatiſm in this muſcle, his breathing was checked ; and when he had difficult breathing, he found great relief by fixing the hands, raiſing the ſhoulders, and acting with the pectoral muſcles. It ſeems confirmed by theſe facts, that aſthmatics take this poſture ; women in labour fix their arms, by reſting upon the arms of their chair ; thoſe who play on wind-inſtruments raiſe the ſhoulders in ſtraining, &c.

back; it ariſes from the lower vertebræ of the loins, from the ſpines and knobs of the back of the ſacrum, and from the back part of the circle of the os ilium: this laſt is the only part that is fleſhy. The flat tendon gradually paſſes into a flat and regular muſcle, which wraps round the ſide of the body; and as it lies over the corner of the ſcapula, it receives a ſmall fleſhy bundle from it; and as it paſſes over the lower ribs, it has ſome tendinous ſlips ſent into it, by which it is attached to the ribs. Its fibres converge: for the lower ones aſcend; the upper ones go directly acroſs. And theſe different orders, not only meet to form its flat tendon, but they croſs each other, like thoſe of the pectoral muſcle. Here alſo the tendon is twiſted, and the upper edge of the muſcle forms the lower edge of the flat tendon; which, paſſing into the axilla, turns under the arm-bone, and is implanted into it, on the inner edge of the bicipital groove. So the tendons of the pectoralis and latiſſimus meet each other; they in fact join face to face, as if the one tendon ended directly in the other; and both united make a ſort of lining for the groove, or a tendinous ſheath for the long tendon of the biceps to run in.

Theſe two muſcles form the axilla or arm-pit; and although each has its peculiar offices, their chief operation is when they coincide in one action; and that action is exceedingly powerful, both by the great ſtrength of either muſcle, and by their being implanted into the arm-bone four inches below the head. The pectoralis major is for pulling the arm forwards, as in laying the arms acroſs the breaſt, or in carrying loads in the arms; and it forms the border of the axilla before. The latiſſimus dorſi has a wider range: when the arm is raiſed, it brings it downwards, as in ſtriking with a hammer; or downwards and backwards, as in ſtriking with the elbow; or in rolling the arm inwards and backwards, as in turning the palm of the hand behind the back; whence it has the obſcene name of MUSCULUS SCALPTOR ANI, or TERSOR ANI; and it forms the back edge of the axilla. The edges of theſe two muſcles receive the preſſure of crutches, and defend the veſſels and nerves: when both muſcles act, the arm is preſſed directly downwards, as in riſing from our ſeat, or in holding a bundle under the arm; or when the arm is fixed, theſe muſcles raiſe the body, as in the example juſt mentioned of riſing from our ſeat, or in walking with a ſhort ſtick, or in raiſing ourſelves by our hands over a high beam.

LXXI. The DELTOIDES is the firſt of thoſe muſcles which ariſe from the ſcapula to be inſerted into the ſhoulder-bone. It is named deltoid muſcle, from its reſembling the letter Δ of the Greeks; it is thick and fleſhy, and covers the top of the ſhoulder, filling up the ſpace betwixt the acromion proceſs and the ſhoulder-bone. It ariſes from all that part of the clavicle which is not occupied by the pectoralis muſcle, and is ſeparated from it only by a fatty line: it ariſes again in another bundle, from the point of the acromion proceſs; and this middle bundle is alſo inſulated by a fatty line on either ſide of it: the third bundle ariſes from the ſpine of the ſcapula, behind the acromion proceſs. And thus the muſcle has three converging heads, viz. a head from the outer end of the clavicle;

vicle; a head from the acromion or tip of the ſhoulder; a head from the ridge of the ſpine; each divided from the other by a fatty line*. Theſe heads or bundles of fibres, meeting about one-third down the humerus, form a ſhort, flat, and ſtrong tendon, which graſps or almoſt ſurrounds the ſhoulder-bone.

Theſe three diſtinct heads muſt be obſerved in ſpeaking of the uſe of the muſcle; for though the chief uſe of the muſcle be to raiſe the arm, this is not the uſe of it in all circumſtances. For the outer and inner heads, lying by the ſide of the ſhoulder-bone, and below the joint, do, when the arm is lying flat by the ſide, aſſiſt the pectoral and latiſſimus dorſi muſcles in drawing it cloſe to the ſide; but when the middle bundle raiſes the arm, in proportion as it raiſes the arm it loſes of its power; and in proportion as it loſes of its power, the ſide portions, having come into a new direction, begin to help: Nay, when the arm is raiſed to a certain point, more power ſtill is required, and the clavicular part of the pectoral muſcle alſo comes to aſſiſt. It is in this ſucceſſion that the ſeveral bundles of fibres act; for if they began all at once to act, the arm ſhould rather be bound down by the lateral portions than raiſed by the middle one.

LXXII. CORACO BRACHIALIS.—The coraco brachialis, ſo named from its origin and inſertion, is a long and rather ſlender muſcle.

It ariſes from the coracoid proceſs of the ſcapula, along with the ſhort head of the biceps muſcle; and it is cloſely connected with this head almoſt in its whole length: it is ſmall at its beginning; it grows gradually thicker as it deſcends; it is all fleſhy, and is inſerted by a very ſhort tendon into the os humeri, nearly about its middle, betwixt the brachialis and the third head of the triceps. It is perforated by the muſculo-cutaneous nerve. This was obſerved by Caſſerius, an Italian anatomiſt; and the muſcle is often named MUSCULUS PERFORATUS CASSERII.

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* Albinus has diſtinguiſhed it into ſeven faſciculi or bundles; a very ſuperfluous accuracy.

Its action is very ſimple, to raiſe the arm obliquely forwards and upwards, and conſequently to give a degree of rotation. It will alſo have a chief effect in pulling the arm towards the ſide.

LXXIII. The SUPRA SPINATUS, is ſo named from its occupying the hollow of the ſcapula above the ſpine.

It ariſes from the back of the ſcapula, from the ſpine, and from the edge or coſta; it is exceedingly thick and fleſhy, filling up all the hollow; and it is firmly incloſed in this triangular hollow by a ſtrong tendinous expanſion, which paſſes from the edge of the ſcapula to the ridge of the ſpine. It is conſequently a muſcle of a triangular figure, thick and ſtrong; it paſſes under the acromion, and degenerates into a tendon there; and going under the acromion, as under an arch, and over the ball of the humerus, it adheres to the capſule of the ſhoulder-joint, and is at laſt implanted by a broad ſtrong tendon into the great tuberoſity on the head of the bone.

It is evidently deſigned for raiſing the humerus directly upwards; and by its attachment to the capſule, the capſule is drawn up when the arm is raiſed; ſo that, though lax, it cannot be catched in the joint. It performs exactly the ſame motion with the middle part of the DELTOIDES, lies in the ſame direction with it, and aſſiſts it.

LXXIV. INFRA SPINATUS, is like the former, in all reſpects, of the ſame uſe, and aſſiſts it.

This alſo is of a triangular ſhape, and is fully one half larger than the ſupra ſpinatus; and as the ſupra ſpinatus ariſes from all the triangular cavity above the ſpine, this ariſes from all the triangular cavity below it.

It ariſes fleſhy from all the back of the ſcapula below the ſpine itſelf, and from all the baſe of the ſcapula below the beginning of the ſpine, and alſo from the lower margin of the ſcapula. It is very thick and ſtrong, filling up the triangular cavity entirely; and it is cloſed in like the former by a ſtrong tendinous expanſion; it begins to grow tendinous about its middle, but it continues alſo fleſhy till it paſſes over the ſocket of the ſhoulder-joint. It alſo is connected with the capſular ligament; is inſerted into the ſame tuberoſity with the former; and has exactly the ſame uſes, viz. preventing the capſule from being catched in the joint, and raiſing the arm upwards, and inclining it a little outwards by a ſlight degree of rotation. And I do believe that one great uſe of theſe two muſcles is, when the arm is much extended backwards, to prevent the head of the humerus from ſtarting out of its ſuperficial ſocket.

LXXV. The TERES MINOR is a third muſcle which co-operates with theſe. This and another are named teres from their appearance, not from their ſhape; for they ſeem round when ſuperficially diſſected, becauſe then their edges only are ſeen ; but when fully diſſected from the other muſcles, they are quite flat. The teres minor is a long, ſmall, fleſhy muſcle ; it ariſes from the angle, and all the lower edge of the ſcapula : it is like the infra ſpinatus ; it becomes early tendinous, but the tendon is accompanied with fleſhy fibres from below ; its flat tendon, in paſſing over the joint, is attached to the capſule, and is finally inſerted into the great tuberoſity of the ſhoulder-bone, ſo that it muſt have exactly the ſame uſes as the two former muſcles. It is ſeparated from the infra ſpinatus by that tendinous expanſion with which the latter is covered ; it looks like a part of the ſame muſcle in its origin, where it lies upon the ſcapula ; but is very diſtinct in its tendon. The ſupra ſpinatus, infra ſpinatus, and teres minor, raiſe the arm.

LXXVI. The TERES MAJOR, is in ſhape like the former, lies lower upon the edge of the ſcapula than the teres minor, and is thicker and longer than it.

It ariſes chiefly from the angle of the ſcapula ; partly from the lower edge of the ſcapula at its back part ; it is connected with the TERES MINOR and INFRA SPINATUS. It is a large, thick, and flat muſcle, and forms a flat ſtrong tendon, which paſſes under the long head of the triceps. It paſſes under the os humeri ; turns round it, and is inſerted into the ridge, on the inner ſide of the groove, and gives ſome tendinous fibres to line the groove. In ſhort, it accompanies the tendon of the latiſſimus dorſi, is inſerted along with it, and may be conſidered as the congener of the latiſſimus dorſi ; and the two tendons are incloſed in one common capſule or ſheath of cellular ſubſtance.

Its uſe, then, is evidently to draw the humerus downwards and backwards, and to perform the ſame rotation of the arms which the latiſſimus dorſi does.

LXXVII. The SUBSCAPULARIS lines all the concavity of the ſcapula like a cuſhion. It is like the ſurface of the ſcapula on which it lies, of a triangular ſhape; and from the convergence of all the fibres, it is completely radiated or fan-like; it is very fleſhy, thick, and ſtrong. The radii are each minutely deſcribed by Albinus; but Sabbattier ſays, with good ſenſe, that he cannot diſtinguiſh them ſo as to deſcribe them accurately; and he might have added, that there was not the ſhadow of a motive for waſting time in ſo trivial an employment as counting the bundles.

It ariſes from the two edges, the baſe, and all the internal ſurface of the ſcapula. And indeed it is to favour this origin that the inner ſurface of the ſcapula is full of little riſings and hollows, to every one of which the muſcle adheres cloſely. Juſt under the coracoid proceſs is the only part from whence it does not ariſe. That little ſpace is filled up with cellular ſubſtance.

Its alternately tendinous and fleſhy fibres are ſo rooted in the ſcapula, and ſo attached to its riſings and depreſſions, that it is difficultly cleaned away from the bone.

The tendon and upper edge of the muſcle is almoſt continuous with the ſupra ſpinatus: but from the manner of its inſertion, its effect is very oppoſite from that of the ſupra ſpinatus; for it goes round the os humeri to its inſertion, and it is fixed to the leſſer tuberoſity; therefore it both pulls the arm backwards and downwards, and performs the rotation like the teres major and latissimus dorsi. It is also like all the other tendons, attached to the capsule, so as to prevent its being entangled; and it is particularly useful by strengthening the shoulder-joint.

OF THE MOTIONS OF THE HUMERUS.

Having thus described all the muscles which move this bone, I shall review the order in which they are arranged, and mark their places and effects.

To distinguish clearly the functions of each muscle, we have but to mark the point to which it is attached.

1. Those implanted above the head of the bone, must raise the arm. Now the supra spinatus, infra spinatus, and teres minor, are implanted into the great tubercle, and raise the arm; and the deltoides is implanted in the same direction, and still lower, so that it performs the same action with a still greater degree of power.

2. There is implanted into the opposite, or lower part of the head, the subscapularis, which, of course, draws the arm directly downwards and backwards.

3. There is implanted into the outer edge of the bicipital groove the pectoralis major, and also the coraco-brachialis, which comes in the same direction; and these two pull the arm directly towards the side, or rather upwards.

4. There are inserted into the inside, or inner side of the groove, the latissimus dorsi and teres major; both of which pull the arm directly backwards. As they bend under the arm, to reach their insertion, they also roll the palm inwards and backwards. And it is easy to

discover

obſerve in what ſucceſſion thoſe muſcles muſt act, to deſcribe the circular and rotatory motions of the arm.

Joints are more ſtrengthened by the origin and inſertion of muſcles around them, than by elaſtic ligaments: for theſe yield or tear; whereas the muſcles, having a living power, react againſt any ſeparating force; they contract, or, in other words, they are ſtrong in proportion to the violence that the joint ſuffers. Thus, in the ſhoulder, the capſule is ſo lax, that there is a mechanical contrivance to prevent its being checked in the joint; and it is moreover ſo weak, that, independent of its yielding eaſily, it is alſo very eaſily torn; but theſe muſcles ſurround the joint ſo fairly, that their ſtrength and their tendinous inſertions into the head of the bone are more than a compenſation for the looſeneſs of its capſular ligament. Were not the muſcles thus cloſely attached, the ſhoulders would be very often diſplaced, the glenoid cavity is ſo ſuperficial, and the burſa ſo lax: and ſurely it is for ſome ſuch purpoſe that the muſcles are planted ſo cloſely round the head of the bone; for when they are implanted at a diſtance from the centre, as one muſcle, the deltoid, is, or as the biceps and triceps of the arm, or as the hamſtrings, or tendo Achillis are, the power is much increaſed. Here, in the humerus, power is ſacrificed to the firmneſs of the joint, and they are all implanted cloſely round the head of the bone.

The joint is in a manner formed by theſe muſcles; for the ſupra ſpinatus, infra ſpinatus, teres major and minor, and the ſubſcapularis, ſurround the joint very cloſely; cover the joint with their flat tendons; and ſo thicken the capſule, and increaſe its ſtrength.

MUSCLES OF THE FORE-ARM.

THE muſcles of the fore-arm are only four; the BICEPS and BRACHIALIS for bending, and the TRICEPS and ANCONÆUS for extending.

LXXVIII. BICEPS BRACHII FLEXOR is univerſally named BICEPS, from its having two very diſtinct heads. It is an exceedingly thick and ſtrong muſcle; for when it contracts, we feel it almoſt like a hard firm ball upon the fore part of the arm; and at the upper and moſt conſpicuous part of this ball is the union of the two heads.

The larger and thicker head ariſes from the coracoid proceſs, by a tendon which extends three inches along the fore part of the muſcle, in the form of an aponeuroſis; but at the back part the tendon is ſhort, and the muſcle is fleſhy, and is attached there to the fleſhy belly of the coraco-brachialis.

The ſecond, or long head, ariſes from the edge of the glenoid cavity, at its upper part; it is exceedingly ſmall and tendinous, and this long tendon runs down in its proper cavity, till, about one-third down the arm, the two heads meet. And though below that it is but one fleſhy belly, yet there, as in other muſcles, the common diviſion betwixt its two origins may be ſtill obſerved.

It is earlier tendinous at the fore part and outer ſide; the tendon there ſends off that aponeurotic expanſion which covers all the fore-arm below, and encloſes its muſcles as in a ſheath. The tendon, at firſt flat and large, becomes gradually ſmaller and rounder; it turns a little in its deſcent, ſo as to lay one flat edge to the radius, and another to the ulna; and it is at laſt implanted into that round tubercle which is on the fore part of the radius, a little below its neck.

The great uſe of the biceps is to bend the fore-arm; which it does with great ſtrength. But as it is inſerted into the tubercle of the radius, when the arm and hand are turned downwards, the biceps, by acting, will pull them upwards, i. e. it will aſſiſt the ſupinators. Since both its heads are from the ſcapula, it will alſo occaſionally move the humerus, as well as the fore-arm.

LXXIX. The BRACHIALIS INTERNUS lies immediately under the biceps, and is a very ſtrong fleſhy muſcle for aſſiſting the biceps in bending the arm. It is called BRACHIALIS from its origin in the fore-arm; and INTERNUS from its being within the biceps, or rather from its being on the inner ſide of the arm.

It ariſes from two-thirds of the os humeri at its fore part, by a ſort of forked head; for it comes down from each ſide of the deltoid. It continues its attachment all the way down the fore part of the humerus to within an inch of the joint. It is very thick, fleſhy, and ſtrong; it is tendinous for about two inches in its fore part; and is inſerted by a flat ſtrong tendon into the coronoid proceſs of the ulna.

Other uſes are aſcribed to it, as the lifting up the capſule to prevent its being pinched; but the chief uſe of it is to bend the fore-arm. In a ſtrong man, it is exceedingly thick, and its edge projects from under the edge of the biceps, and is ſeen in the lateral view.

LXXX. TRICEPS EXTENSOR.—Upon the back part of the arm three muſcles are deſcribed: the extenſor longus, the extenſor brevis, and the brachialis externus; but it is, in fact, one three-headed muſcle.

The longeſt head of this muſcle is in the middle. It ariſes by a flat tendon of one inch in thickneſs, from the edge of the ſcapula under the neck, and a little way from the origin of the long head of the biceps; and it is under this head that the tendon of the teres major paſſes to its inſertion.

The ſecond head is on the outſide of the arm, next in length to this. It ariſes from the arm-bone under the great tuber, and juſt below the inſertion of the teres minor. Theſe two meet about the middle of the humerus.

The third, or internal head, is the ſhorteſt of all. It begins at the inner ſide of the humerus, juſt under the inſertion of the teres major; and it ariſes from the inner part of the humerus, all the way down, and joins juſt where the ſecond head joins (i. e. about the middle). All theſe heads ſtill continue adhering to the humerus (as the brachialis does on the fore ſide), quite down to within an inch of the joint; and then a ſtrong thick tendon is formed, by which it is implanted ſtrongly in the projecting heel of the ulna, named olecranon; by which projection it has great power, and the power is increaſed by an increaſed length in dogs, and other animals which run or bound.

The whole forms a very thick and powerful muſcle, which covers and embraces all the back part of the arm; and its uſe is too ſimple to admit of any farther explanation, than juſt to ſay that it extends the hinge-joint of the elbow with great power; and that by its long head it may aſſiſt alſo to bend the ſhoulder outwards and backwards.

Beſides bones, there is alſo another ſource of attachment for muſcles, that is, the tendinous expanſions: for the expanſions, which go on the ſurface like ſheaths, alſo dive betwixt the muſcles, and form ſepta or partitions, from which their fibres ariſe.

One tendinous expanſion begins from the clavicle and acromion proceſs, or rather comes down from the neck: it is then ſtrengthened by the tendon of the deltoid muſcle; it deſcends, covering all the arm; and before it goes down over the fore-arm, it is again reinforced chiefly by the biceps, but alſo by the tendon of the extenſor triceps. One remarkable proceſs or partition of this general faſcia is ſent in from the ſheath to be fixed to the outſide of the humerus, all the way down to the ridge of the outer condyle. Another partition goes down, in like manner, to the inner condyle, along the ridge which leads to it; then the faſcia, taking a firm hold on the condyles, is greatly ſtrengthened about the elbow, and goes over the fore-arm, incloſing its muſcles in a very firm and cloſe ſheath; and it ſends partitions down among the ſeveral layers of muſcles in the fore-arm, which gives each of them a firm hold.

LXXXI. The ANCONÆUS is a ſmall triangular muſcle, placed on the back part of the elbow. It ariſes from the ridge and from the external condyle of the humerus, by a thick, ſtrong, and ſhort tendon. From this it becomes fleſhy; and after running about three inches obliquely backwards, it is inſerted by its oblique fleſhy fibres into the back part or ridge of the ulna.

It is manifeſtly deſigned for the extenſion of the fore-arm, and has only that one ſimple action.

MUSCLES OF THE RADIUS, CARPUS, AND FINGERS.

The whole fore-arm is covered with a maſs of muſcles of great ſtrength, and ſo numerous and intricate, with a catalogue of names ſo difficult, and ſo diſtracting, that they ſhould be arranged and claſſed with much care, explaining to the ſtudent the reaſon and value of their names, and the place and effect of each claſs.

The fore-arm is covered with a faſcia or ſtrong tendinous web, which, like that which covers the temporal muſcle, gives both origin and ſtrength to the muſcles which lie under it; which divides the ſeveral layers one from another; and helps them in their ſtrong actions, with that kind of ſupport which workmen feel in binding their arms with thongs. This faſcia is ſaid to proceed from the ſmall tendon of the biceps muſcle, though that were but a ſlender origin for ſo great a web of tendon, which not only covers the ſurface of the muſcles but enters among their layers. This faſcia really begins in the ſhoulder, and has an addition and an increaſe of ſtrength from every point of bone; it is aſſiſted by each tendon, becauſe the tendons and faſcia are of one nature over all the body, and its connection with the tendon of the biceps is quite of another kind from that which has been ſuppoſed. I would not allow that the biceps tendon expands into the faſcia, but rather that the web receives the biceps tendon, which is implanted into it; and for this wiſe purpoſe, that when the fore-arm is to ſtrike, or the hand to graſp, the biceps firſt moves, and by making the faſcia tenſe, prepares the fore-arm for thoſe violent actions which are to enſue. Thus, it may be defined a web of thin but ſtrong tendon, which covers all the muſcles of the fore-arm; makes the ſurface before diſſection firm and ſmooth; ſends down partitions, which are fixed into the ridges of the radius and ulna, enabling thoſe bones to give a broader origin to the muſcles, eſtabliſhing a ſtrong connection among the ſeveral layers, and making the diſſection always difficult, and never fair nor clean.

The motions to be performed by the muſcles which lie upon the fore-arm are theſe three; to roll the hand; to bend the wriſt; to bend the fingers.

1. The turning of the hand, which is performed by rolling the radius on the ulna, is named pronation and ſupination. When we turn the palm down, it is ſaid to be prone; when we turn the palm upwards, it is ſupine. This is pronation and ſupination. The muſcles which perform theſe motions are the PRONATORS and the SUPINATORS; and the motion itſelf is beſt exemplified in the turning of a key in a lock, or in the guards of fencing, which are formed by a continual play of the radius upon the ulna, carrying the wriſt round in circles.

2. The wriſt is called the CARPUS, and therefore thoſe muſcles which ſerve for bending or extending the wriſt are the FLEXORS and EXTENSORS of the carpus.

3. The bending and extending of the fingers cannot be miſtaken; and therefore the flexors and extenſors of the fingers need not be explained.

Theſe muſcles are denominated from their uſes chiefly; but if two muſcles perform one motion, they may be diſtinguiſhed by ſome accident of their ſituation or form. And thus, if there be two benders of the fingers, one above the other, they are named FLEXOR SUBLIMIS, and FLEXOR PROFUNDUS, i. e. the deep and the ſuperficial flexors. If there be two flexors of the carpus, one is named FLEXOR RADIALIS CARPI, by its running along the radius; the other FLEXOR ULNARIS CARPI, from paſſing along in the courſe of the ulna. And if there be two pronators, one may be diſtinguiſhed as the PRONATOR TERES, from its round ſhape, the other as the PRONATOR QUADRATUS, from its ſquare form. And this, I truſt, will ſerve as a key to what is found to be a ſource of inextricable confuſion.

It will be eaſy to make the origins and inſertions of theſe muſcles ſtill more ſimple than their names; for all the muſcles ariſe from two points, and have but two uſes. This aſſertion ſhall be afterwards qualified, with a few exceptions; but at preſent it ſhall ſtand for the rule of our demonſtration; for all the muſcles ariſe from two points, the external and the internal condyle.

The internal condyle is the longer one, and gives moſt power; more power is required for bending, graſping, and turning the hand; therefore all the muſcles which bend the hand, all the muſcles which bend the fingers, and the pronator, or that which turns the palm downwards, ariſe from the internal condyle.

The external condyle is ſhorter; it gives leſs power; there is little reſiſtance to the opening of the hand, and little power is required in extending the fingers; and ſo all the muſcles which extend the wriſt or the fingers, or roll the hand outwards to turn it ſupine, ariſe from the external condyle.

So that when we hear a pronator or a flexor named, we know that the origin muſt be the internal condyle, and the inſertion is expreſſed by the name: thus a pronator radii is a turner of the radius, and goes to the radius; a flexor carpi goes to the wriſt; a flexor digitorum goes to the fingers; and a flexor pollicis goes to the thumb: All the flexors, and all the pronators, iſſue from that point as from a centre. And, again, when a ſupinator or an extenſor is named, we know where to look for it; for they alſo go out from one common point, the external condyle; and the ſupinator radii goes to the radius; the extenſor carpi goes to the wriſt; the extenſor pollicis goes to the thumb; and the extenſor indicis to the fore-finger.

FLEXORS.

The MUSCLES cloſing and bending the hand ariſe from the internal condyle. They are,

The PRONATOR TERES RADII, turning the radius.

PALMARIS LONGUS, FLEXOR CARPI RADIALIS, ——— ——— ULNARIS	bending the wriſt.
——— DIGITORUM SUBLIMIS, ——— ——— PROFUNDUS, ——— LONGUS POLLICIS,	bending the fingers and thumb.

And, laſtly, there is the PRONATOR QUADRATUS, which is the ſingle muſcle out of that ſcheme which I have propoſed; lying flat upon the interoſſeous membrane near the wriſt.

LXXXII. The PRONATOR TERES RADII is of the outermoſt layer of muſcles, is ſmall and round; named pronator from its office of turning the radius, and teres from its ſhape, or rather to diſtinguiſh it from the pronator quadratus, which is a ſhort ſquare muſcle which lies deep again, being laid flat upon the naked bones.

The pronator teres ariſes chiefly from the internal tubercle of the humerus, at its lower and fore part: it has a ſecond origin from the coronoid proceſs of the ulna. Theſe form two portions, betwixt which paſſes the radial nerve. The muſcle thus formed is conical; is gradually ſmaller from above downwards; is chiefly fleſhy, but is alſo a little tendinous, both at its origin and at its inſertion; and ſtretches obliquely acroſs the fore-arm, paſſing over the other muſcles to be inſerted in the outer ridge of the radius, about the middle of its length.

Its uſe is to turn the hand downwards, by turning the radius; and it will alſo, in ſtrong actions, be brought to bend the fore-arm on the arm; or the reverſe, when the fore-arm is fixed, and we are to raiſe the trunk by holding with the hands.

LXXXIII. The PALMARIS LONGUS is a long thin muſcle, which, although it ſeems to have another uſe in its expanſion into the aponeuroſis; yet is truly, by its inſertion into the annular ligament of the wriſt, a flexor of the wriſt, and, in ſome degree, a pronator of the radius.

It ariſes from the internal condyle of the os humeri, and is the firſt of five muſcles which have one common tendon, and which go out, like radii, from one common centre; viz. the palmaris, the flexor radialis, the flexor ulnaris, the flexor digitorum ſublimis, the flexor digitorum profundus.

The palmaris longus ariſes from the inner condyle of the os humeri, and alſo from the intermuſcular tendon, which joins it with the flexor radialis and flexor digitorum ſublimis, and from the internal ſurface of the common ſheath. Its fleſhy belly is but two inches and a half or three inches in length; and its long ſlender tendon deſcends along the middle of the fore-arm to be inſerted into the fore part of the annular ligament of the wriſt, juſt under the root of the thumb. This tendon ſeems to give riſe to the very ſtrong thick aponeuroſis of the palm of the hand (under which all the muſcles of the hand run, and which conceals the arch of blood veſſels, and protects them), thence the muſcle has its name. But it is a very common miſtake to think, that becauſe tendons are fixed to the ſheaths, the ſheaths are only productions of the tendons; whereas the ſheaths do truly ariſe from bones. The faſcia, which the deltoides is thought to form, ariſes from the acromion and clavicle; and the faſcia, which the biceps is thought to produce, ariſes from the condyles of the humerus; and that great ſheath of tendon which is made tenſe by the muſculus faſcialis of the thigh, does not ariſe from that muſcle, but comes down from the ſpine of the ilium, ſtrengthened by expanſions from the oblique muſcles of the abdomen. In the preſent inſtance, we have the cleareſt proof of faſcia being derived from ſome other ſource than the tendons; for ſometimes the palmaris muſcle is awanting, when ſtill the tendinous expanſion is found, and ſome pretend to ſay that the expanſion is awanting when the muſcle is found. The aponeuroſis, which covers the palm, is like the palm itſelf, of a triangular figure; it begins from the ſmall tendon of the palmaris longus, and gradually expands, covering the palm down to the ſmall ends of the metacarpal bones. Its fibres expand in form of rays; and towards the end there are croſs bands which hold them together and make them ſtronger; but it does not cover the two outer metacarpal bones (the metacarpal of the fore-finger or of the little finger), or it only covers them with a very thin expanſion.

Now this palmar expanſion alſo ſends down perpendicular diviſions, which take hold on the edges of the metacarpal bones: and thus there being a perpendicular diviſion to each edge of each metacarpal bone, there are eight in all, which form canals for the tendons of the fingers, and for the lumbricales muſcles.

LXXXIV. The PALMARIS BREVIS is a thin flat cutaneous muſcle, which ariſes properly from the edge of the palmar aponeuroſis, near to the ligament of the wriſt; whence it ſtretches acroſs the hand in thin faſciculi of fibres, which are at laſt inſerted into the metacarpal bone, on which the little finger ſtands, and into the ſkin and fat on the edge of the palm. This is the PALMARIS CUTANEUS of ſome authors, for which we can find no uſe except it were that of drawing in the ſkin of the hand, and perhaps making the palmar expanſion tenſe.

LXXXV. The FLEXOR CARPI RADIALIS is a long thin muſcle ariſing from the inner condyle, ſtretching along the middle of the fore-arm ſomewhat in the courſe of the radius, and is one of the five muſcles which riſe by one common tendon, and which are, for ſome length, tied together.

It ariſes tendinous from the inner condyle; the tendon very ſhort and thick. This tendon, at its origin, is ſplit into many (ſeven) heads, which are interlaced with the heads of the ſublimis, profundus, palmaris, &c.; conſequently this muſcle not only ariſes from the internal condyle, but alſo from the intermuſcular partitions (as from that betwixt it and the ſublimis): it forms a long tendon, which, becoming at laſt very ſmall and round, runs under the annular ligament: it runs in a gutter peculiar to itſelf; but in this canal it is moveable, not fixed: it then expands a very little, and is inſerted into the metacarpal bone of the fore-finger, alſo touching that which ſupports the thumb.

Its uſe is chiefly to bend the wriſt upon the radius. But when we conſider its oblique direction, it will alſo be very evident that it muſt have ſome effect in pronation; and this, like many of the muſcles of the fore-arm, although deſigned for a different purpoſe, will alſo have ſome effect in bending the fore-arm at the elbow-joint.

LXXXVI. The FLEXOR CARPI ULNARIS is a long muſcle, much like the former; but as its courſe is along the radius or upper edge of the fore-arm, this runs along the ulna or lower edge.

It comes off tendinous from the inner condyle of the os humeri, by the common tendon of all the muſcles: It has alſo, like the pronator teres, a ſecond head (viz. from the olecranon proceſs of the ulna), which ariſes fleſhy; and as the radial nerve paſſes betwixt the heads of the pronator teres, the ulnar nerve perforates this muſcle betwixt its heads. The flexor ulnaris paſſes all along the flat ſide of the ulna, betwixt the edge of the ſublimis and the ridge of the bone: and here it has a third origin of oblique fibres, which come from the edge of the ulna two-thirds of its length. Its tendon begins early on its upper part, by which it has ſomewhat the form of a penniform muſcle. It has ſtill a fourth origin from the intermuſcular partition, which ſtands betwixt it and the ſublimis flexor; and is alſo attached to the internal ſurface of the common faſcia of the arm. Its long tendon is at laſt inſerted into the os piſiforme at its fore part, where it ſends off a thin tendinous expanſion to cover and ſtrengthen the annular ligament; and alſo a thin expanſion towards the ſide of the little finger to cover its muſcles.

This is to balance the flexor radialis: acting together, they bend the wriſt with great ſtrength; and when this acts alone, it pulls the edge of the hand ſidewiſe.

LXXXVII. The FLEXOR DIGITORUM SUBLIMIS, is named SUBLIMIS from being the more ſuperficial of the two muſcles; PERFORATUS, from its tendon being perforated by the tendon of that which lies immediately below. It lies betwixt the palmaris longus and flexor ulnaris. It is a large fleſhy muſcle; and not only its tendons, but its belly alſo, is divided into four faſciculi, correſponding with the fingers which it is to ſerve.

It ariſes from the internal condyle, along with the other four muſcles; from the ligament of the elbow joint; from the coronoid proceſs of the ulna; and from the upper part of the radius, at the ſharp ridge. By theſe origins it becomes very fleſhy and thick; and a little above the middle of the fore-arm divides into four fleſhy portions, each of which ends in a ſlender tendon. The tendons begin at the middle of the fore-arm or near the diviſion; but they continue to be joined to each other by fleſhy fibres ſome way down: and indeed the fleſhy fibres ceaſe only when it is about to paſs under the annular ligament of the wriſt. At this place a cellular ſtringy tiſſue connects the tendons with each other, and with the tendons of the profundus; but after they have paſſed under the ligament, they expand towards the fingers which they are to ſerve. They each begin to be extended and flattened, and to become thinner; they begin to appear cleft; they paſs by the edge of the metacarpal bones, and eſcape from under the palmar aponeuroſis: and where it ends, viz. at the root of the fingers, a tendinous ſheath or burſa begins, in which theſe tendons continue to be incloſed.

The tendons are fairly ſplit juſt oppoſite to the top of the firſt phalanx: and it is at this point that the tendons of the deeper muſcle paſs through this ſplitting. The flattened tendon parts into two, and its oppoſite edges diverge; the back edges meet behind the tendons of the profundus, and form a kind of ſheath for them to paſs in; and then they proceed forward along the ſecond phalanx, into the fore part of which they are implanted.

This muſcle is exceedingly ſtrong. Its chief office is to bend the ſecond joint of the fingers upon the firſt, and the firſt upon the metacarpal bone. And in proportion to the number of joints that a muſcle paſſes over, its offices muſt be more numerous; for this one not only moves the fingers on the metacarpus, but the hand upon the wriſt, and even the fore-arm upon the arm.

LXXXVIII. The FLEXOR DIGITORUM PROFUNDUS vel PERFORANS, has the ſame origin, inſertion, and uſe, inſomuch that the deſcription of the laſt is applicable to this muſcle in almoſt every point. This is of a lower ſtratum of muſcles; it lies deeper, and under the former, whence its name: and by this deeper ſituation it is excluded from any hold upon the tubercle of the humerus.

It ariſes from the ulna, along its internal ſurface; from the whole ſurface of the interoſſeus ligament; and alſo in ſome degree from the intermuſcular membrane, which ſeparates this from the ſublimis.

This muſcle is ſmall, we may ſay compreſſed, above; but it grows pretty ſtrong and fleſhy near the middle of the arm; it divides above the middle of the arm into four portions, correſponding with the four fingers; and it is about the middle of the arm that the tendons begin, and continue to receive muſcular fibres from behind, all down to the ligament of the wriſt. At the wriſt theſe tendons are tied to each other, and to the tendons of the ſublimis, by looſe tendinous and cellular fibres. They diverge from each other, after paſſing under the annular ligament; and going along in the hollow of the bones, under the tendons of the ſublimis, they firſt paſs through the bridges formed by the palmar aponeuroſis, then enter the ſheaths of the fingers, and finally paſs through the perforations of the ſublimis, a little below the ſecond joint of the fingers. At this place the perforating tendons are ſmaller and rounder for their eaſy paſſage; and after paſſing they again expand and become flat. They alſo above this appear themſelves ſplit in the middle, without any evident purpoſe; they paſs the ſecond phalanx, and are fixed into the root of the third. And every thing that is ſaid of the uſe of the ſublimis may be applied to this, only that its tendons go to the furtheſt joint.

LXXXIX. LUMBRICALES.—I ſhall here deſcribe, as a natural appendage of the profundus, the LUMBRICALES muſcles, which are four ſmall and round muſcles, reſembling the earth-worm in form and ſize; whence they have their name. They ariſe in the palm of the hand, from the tendons of the profundus, and are therefore under the ſublimis, and under the palmar aponeuroſis. They are ſmall muſcles, with long and very delicate tendons. Their fleſhy bellies are about the length of the metacarpal bones, and their ſmall tendons ſtretch over two joints, to reach the middle of the ſecond phalanx. The firſt lumbricalis is larger than the ſecond, and the two firſt larger than the two laſt.

The firſt ariſes from the ſide of the tendon of the fore-fingers, which is next to the radius; the others ariſe in the forks of the tendons; and though they riſe more from that tendon which is next the ulna, yet they have attachments to both. Their tendons begin below the firſt joint of each finger; they run very ſlender along the firſt phalanx, and they gradually wind around the bone; ſo that though the muſcles are in the palm of the hand, the tendons are implanted in the back parts of the fingers; and their final connection is not with the bending tendons of the ſublimis and profundus, but with tendons of the extenſor digitorum, and with the tendons of the external interoſſei muſcles, with which they are united by tendinous threads.

Hence their uſe is very evident: they bend the firſt joint, and extend the ſecond; they perform alternately either office: when the extenſors act, they aſſiſt them by extending the ſecond phalanx or joint: when the flexors act, and keep the firſt and ſecond joint bended, the extending effect of theſe ſmaller muſcles is prevented, and all their contraction muſt be directed ſo as to affect the firſt joint only, which they then bend.

They are chiefly uſeful in performing the quick ſhort motions, and ſo they are named by Cowper the muſculi fidicinales, as chiefly uſeful in playing upon muſical inſtruments.

XC. The FLEXOR LONGUS POLLICIS is placed by the ſide of the ſublimis or perforatus, and lies under the extenſor, or rather extenſores carpi. It runs along the inner ſide of the radius, whence chiefly it ariſes.

Its origin is from all the internal face of the radius downwards; from the place where the biceps is inſerted, and from the interoſſeous ligament, all the length down to the origin of the pronator quadratus: nor does it even ſtop here; for the tendon continues to receive fleſhy ſlips all the way down to the entry, under the ligament of the wriſt. It has often alſo another head, which ariſes from the condyle of the humerus and the fore part of the ulna; which head is tendinous, and joins near the top of that origin which comes from the radius.

It becomes tendinous very high, i. e. above the middle of the arm; and its ſmall tendon paſſes under the annular ligament, glides in the hollow of the os metacarpi pollicis, and ſeparates the ſhort flexor into two heads; paſſes betwixt the two ſeſamoid bones in the firſt joint of the thumb, and running in the tendinous ſheath, it reaches at laſt the end of the fartheſt bone, to be inſerted into the very point of it.

There is ſometimes ſent off from the lower part of the muſcle a ſmall fleſhy ſlip, which joins its tendon to the indicator tendon of the ſublimis.

Its uſes, we conjecture, are exactly as of thoſe of the other flexors, to bend the laſt phalanx on the firſt, the firſt on the metacarpal bones, and occaſionally the wriſt upon the radius and ulna.

XCI. The PRONATOR QUADRATUS, ſo named from its ſhape and form, is one of the moſt ſimple in its action, ſince it ſerves but one direct purpoſe, viz. turning the radius upon the ulna.

It lies flat upon the interoſſeous ligament, upon the fore part of the arm, about two inches above the wriſt; it is nearly ſquare, and is about three inches in length and breadth. Its fibres go obliquely acroſs, betwixt the radius and ulna. It ariſes from the edge of the ulna, adheres to the interoſſeous ligament, and goes to be implanted into the edge of the radius. It turns the radius upon the ulna; and this muſcle, and in ſome degree alſo the flexor pollicis, are the only muſcles which do not come fairly under that arrangement by which I have endeavoured to explain the muſcles of the fore-arm.

EXTENSORS.

The muſcles which lie upon the outer ſide of the fore-arm, the ſupinators and the extenſors of the fingers and wriſt, all ariſe from one point, the external condyle of the humerus, and are all delivered in this liſt:

The EXTENSOR CARPI RADIALIS LONGIOR, The EXTENSOR CARPI RADIALIS BREVIOR, The EXTENSOR CARPI ULNARIS,	all extend the wriſt.

The SUPINATOR LONGUS,—turns the palm upwards.

The EXTENSOR COMMUNIS DIGITORUM,—extends all the fingers, and unfolds the hand.

The EXTENSOR PRIMI INTERNODII POLLICIS, The EXTENSOR SECUNDI INTERNODII POLLICIS, The EXTENSOR TERTII INTERNODII POLLICIS,	extend the ſeveral joints of the thumb.

The EXTENSOR PRIMI DIGITI, vel INDICATOR,—extends the fore-finger.

The EXTENSOR MINIMI DIGITI, vel AURICULARIS,—extends the little finger.

All theſe muſcles ariſe from one point, the external condyle. They all roll the radius outwards, or extend the wriſt, or extend the fingers. As the muſcles which bend need more fibres and greater ſtrength, they ariſe from the internal condyle, which is the larger; they lie in a deep hollow, for the bones of the fore-arm bend to conceal them, and they form a very thick fleſhy cuſhion; but the extenſors requiring leſs power, ariſe from the ſhorter proceſs of the outer condyle, are on the convex ſide of the arm, and are thin, having few fibres: for though there is a large maſs of fleſh on the inner ſide of the arm, forming two big flexors, there is only a thin layer on the outer ſide of the arm, forming one flat and weak extenſor.

XCII. SUPINATOR RADII LONGUS. This muſcle forms the very edge of the fore-arm: It ariſes by many ſhort tendinous fibres from the ridge of the humerus, above the external condyle, which origin is fully two inches in length above the condyle. It alſo ariſes from the inter-muſcular membrane; and, as it ſtands on the very edge of the fore-arm, it runs betwixt the flexor and extenſor radialis. It becomes thicker as it paſſes the elbow-joint, and there gives a very peculiar form to the arm: It then becomes ſmaller, and forms a flat tendon, which is quite naked of fleſh from the middle of the radius, or a little below, down to the wriſt. This tendon becomes gradually ſmaller till it reaches the wriſt, where, expanding a little, it is inſerted into the radius, juſt in the tuber of its lower head.

Its uſe is perhaps chiefly as a ſupinator, but it is placed juſt upon the edge of the arm: it ſtands as a ſort of intermedium betwixt the two ſets of muſcles; it is fixed indeed rather upon the internal ſurface of the radius; but yet when the ſupination is complete, when the hand is rolled very much outward, it will become a pronator.

It is all at once ſupinator and pronator, and, for a moſt evident reaſon, a flexor alſo of the fore-arm; ſince its origin is at leaſt two inches up the humerus, above the joint of the elbow.

XCIII. The EXTENSOR CARPI RADIALIS LONGIOR has the additional name of longior or primus, to diſtinguiſh it from the next. It is almoſt entirely covered with the laſt muſcle, the ſupinator.

It ariſes from the ridge of the humerus above the external condyle, and juſt under the origin of the ſupinator; it deſcends all along the back of the radius; and after having become a thick fleſhy belly, it degenerates a little lower than the middle of the radius into a thin flat tendon, which becomes ſlender and ſmall as it deſcends; and turning a little more towards the back of the radius, it then paſſes over the wriſt, and goes along with the tendon of the extenſor brevior, under the annular ligament, paſſing in a groove of the radius; at laſt it is inſerted into the root of the metacarpal bone of the fore-finger, in that edge next the thumb.

It is chiefly an extenſor of the wriſt: in pronation, it pulls the wriſt directly backwards; in ſupination, it moves the hand ſidewiſe. It is alſo a pronator when the hand is turned back to the greateſt degree; and from its origin, high upon the ſhoulder-bone, it is alſo a flexor of the fore-arm.

XCIV. EXTENSOR CARPI RADIALIS BREVIOR. This muſcle is almoſt the ſame in deſcription, name, and uſe, with the former. It ariſes from the external condyle; and here a common tendon for many muſcles is formed, juſt as in the internal condyle; for from this point ariſe the extenſor brevis, extenſor digitorum, extenſor minimi digiti, extenſor carpi ulnaris.

The extenſor carpi radialis brevior ariſes from the outer condyle of the humerus, by the common tendon; it alſo ariſes from the aponeuroſis, which lies betwixt the extenſor digitorum and this; it grows a pretty large fleſhy belly, and begins like the laſt to be tendinous below the middle of the radius; ſo that this muſcle continues fleſhy lower than the laſt one. Its tendon is alſo much larger and thicker; it runs under the annular ligament, in the ſame channel with the extenſor longior; it expands a little before its inſertion, which is into the fore part of the metacarpal bone of the middle finger, a little towards that edge, which is next to the radius: Some little fibres paſs from this tendon to the metacarpal bone of the fore-finger.

All that was ſaid concerning the extenſor longus may be ſaid of this; for all the three laſt muſcles lie ſo ambiguouſly on the edge of the arm, that though they are regularly ſupinators and extenſors, they become pronators and flexors in certain poſitions of the hand.

XCV. Extensor carpi ulnaris.—By the name merely of this muſcle we know its extent and courſe, its origin, inſertion, and uſe.

It is one of the muſcles which belong to the common tendon, ariſing from the external tubercle of the os humeri: It lies along the ulnar edge of the arm; it ariſes alſo from the intermuſcular membrane, which ſeparates this from the extenſor digitorum and the extenſor digiti minimi; and chiefly it is attached to the internal ſurface of the common ſheath. It ariſes alſo from the face and edge of the ulna the whole way down; its tendon begins in the middle of its length, and is accompanied all down to the wriſt with feather-like fleſhy fibres.

It is fixed into the outſide of the lower head of the metacarpal bone of the little-finger.

Its uſe is to extend the carpus. And it may be now obſerved, that when the two extenſors of the wriſt, the radialis and ulnaris, act, the hand is bent directly backwards; that when the flexor radialis and extenſor radialis act together, they bend the thumb towards the radius; and that when the flexor ulnaris and extenſor ulnaris act, they bend the little-finger towards the ulna, as in cutting with the edge of the hand: thus a circle may be deſcribed by acting with thoſe in ſucceſſion.

XCVI. Extensor digitorum communis.—This muſcle correſponds with the ſublimis and profundus, and antagoniſes them, and reſembles them in ſhape as in uſe. It covers the middle of the fore-arm at its back, and lies betwixt the extenſor radialis ſecundus and the extenſor minimi digiti.

Its origin is chiefly from the outer condyle, by a tendon common to it, with the extenſor carpi brevior, and alſo from the intermuſcular membrane, which ſeparates it on one ſide from the extenſor minimi digiti, and on the other from the extenſor carpi brevis, and alſo from the back part of the common ſheath. It grows very fleſhy and thick as it deſcends, and about the middle of the fore-arm it divides itſelf into three ſlips of very equal ſize. But though the tendons begin ſo high, they continue, like thoſe of the flexors, to receive fleſhy penniform fibres all down, almoſt to the annular ligament. Theſe tendons are tied together by a looſe web of fibres; and being gathered together, they paſs under the ligament in one common and appropriated channel. Having paſſed this ligament, they diverge, and grow flat and large; and they all have the appearance of being ſplit by a perpendicular line. They are quite different from the flexor tendons in this, that they are all tied to each other by croſs bands; for a little above the knuckles, or firſt joint of the fingers, all the tendons are joined on the back of the hand by ſlips from the little-finger to the ring, from the ring to the mid-finger, and from that to the fore-finger. So that it ſeems to be one ligament running quite acroſs the back of the hand. It would be fooliſh to deſcribe them more minutely; for the croſs bands change their places, and vary in every ſubject, and in ſome they are not found.

After this the tendons paſs over the heads of the metacarpal bones, along the firſt phalanx of the fingers; and being there joined by the tendons of the interoſſei and lumbricales, they altogether form a ſtrong tendinous ſheath, which ſurrounds the back of the fingers.

Now, it is to be remembered, that this muſcle ſerves only for the fore, middle, and ring fingers: That if it moves the little finger, it is only by a ſmall ſlip of tendinous fibres, which it often gives off at the general divergence, but ſometimes not; ſometimes it gives one ſlip, ſometimes two, often none at all. And ſo the little-finger has its proper extenſor quite diſtinct from this.

The uſe of this muſcle is to extend all the fingers; and when they are fixed, it will aſſiſt the extenſors of the wriſt, as in ſtriking backwards with the knuckles. And ſince there is but one extenſor muſcle, the croſs tendons are a proviſion againſt the bad conſequences of any ſingle tendon being cut acroſs.

XCVII. The EXTENSOR MINIMI DIGITI, named alſo AURICULARIS from its turning up the little finger, as in picking the ear, ſhould really be deſcribed with the laſt muſcle. If we ſee the origin, courſe, and uſe of this muſcle exactly the ſame with the common extenſor, why ſhould we not reckon it as a ſlip of the common extenſor, appropriated to the little finger?

Its origin is from the outer condyle, along with the other tendons. It alſo adheres ſo cloſely both to the tendinous partitions, and to the internal ſurface of the common faſcia, that it is not eaſily ſeparated in diſſection. It begins ſmall, with a conical kind of head; it gradually increaſes in ſize; it is pretty thick near the wriſt; it adheres all along to the common extenſors of the fingers; it begins to be tendinous about an inch above the head of the ulna; it continues to receive fleſhy fibres down to the annular ligament; and it paſſes under the annular ligament in a channel peculiar to itſelf, which is indeed the beſt reaſon for making this a diſtinct muſcle.

This channel has a very oblique direction; and the tendon, like all the others, expands greatly in eſcaping from the ligament of the wriſt. It is connected with the other tendons in the manner I have deſcribed. Cloſe to the wriſt, it is connected with the tendon of the ring-finger, by a ſlip which comes from it; and at the knuckle, and below it, it is again connected with the tendons both of the ring-finger and of all the others by the croſs bands or expanſions.

Whatever has been ſaid of the uſe of the laſt muſcle is to be underſtood of this; as its extending its proper finger, aſſiſting the others by its communicating band, and in its extending the wriſt when the fiſt is clenched. Its inſertion is into the back of the ſecond joint of the little-finger, along with the interoſſæi and lumbricales. Its tendon has alſo a ſmall ſlit; for the head of the proper extenſor of the little-finger, and the heads of the common extenſors of the others, are inſerted into the top of the ſecond phalanx, juſt under the firſt joint. They ſend off at the ſides tendinous ſlips, which, paſſing along the edges of the bones, do, in conjunction with the tendons of the interoſſæi and lumbricales, form a ſplit tendon, which meets by two curves at the foot of the laſt bone of the fingers to move the laſt joint.

XCVIII. The EXTENSOR PRIMUS POLLICIS, is the ſhorteſt of the three extenſors of the thumb. It is named by Albinus and others ABDUCTOR LONGUS; but ſince every muſcle that extends the thumb muſt pull it away from the hand, every one of them might be with equal propriety named abductors.

The extenſor primus lies juſt on the fore edge of the radius, croſſing it obliquely.

It ariſes about the middle of the fore-arm, from the edge of the ulna, which gives riſe to the interoſſeous membrane itſelf, and alſo from the convex ſurface of the radius.

The fleſhy belly commonly divides itſelf into two or three, ſometimes four, fleſhy ſlips, with diſtinct tendons; which croſſing the radius obliquely, ſlip under the external ligament of the carpus, and are implanted into the root of the firſt metacarpal bone, or rather of the firſt phalanx of the thumb, towards the radial edge; ſo that its chief uſe is to extend the thumb, and to incline it a little outwards towards the radius. It muſt alſo, like the extenſors of the fingers, be an extenſor of the wriſt: and it evidently muſt, from its oblique direction, aſſiſt in ſupination.

XCIX. The EXTENSOR SECUNDUS POLLICIS is longer than the firſt. It is named by Douglas the extenſor ſecundi internodii pollicis; by Albinus the extenſor minor pollicis.

This muſcle lies cloſe by the former. It ariſes juſt below it, from the ſame edge of the radius, and from the ſame ſurface of the interoſſeous membrane; it runs along with it in the ſame bending courſe; and, in ſhort, it reſembles it ſo much, that Winſlow has reckoned it as part of the ſame muſcle.

Its origin is from the edge of the ulna, the interoſſeous ligament, and the radius. Its ſmall round tendon paſſes ſometimes in a peculiar channel, ſometimes with the extenſor primus. It goes over the metacarpal bone of the thumb; it expands upon the bone of the firſt phalanx; and it is inſerted juſt under the ſecond joint.

It extends the ſecond bone of the thumb upon the firſt; it extends the firſt bone alſo; and it extends the wriſt, and, by its oblique direction, contributes to ſupination.

C. EXTENSOR TERTIUS POLLICIS.—This which bends the third joint is called in common the extenſor longus pollicis. And here is a third muſcle, which, in form, and place, and function, correſponds with the two former ones.

Its origin is from the ridge of the ulna, and from the upper face of the interoſſeous membrane: and it is a longer muſcle than the others; for it begins high, near the top of the ulna, and continues the whole way down that bone, and is very fleſhy and thick. It is penniform all the way down to the ligament of the wriſt; and its ſmall tendon paſſes the ligament in a peculiar ring. This tendon appears ſplit, like thoſe of the fingers; it goes along the ulnar ſide of the firſt bone of the thumb, reaches the ſecond, and is implanted there by a ſmall ſlip of tendon; and being expanded, it ſtill goes forward, to be inſerted once more into the third bone of the thumb at its root.

Its uſe is evident after deſcribing the others; for we have only to add another joint for motion. It moves the laſt joint of the thumb, then the ſecond, then its metacarpal bone upon the carpus; and if that be held firm, it will extend the carpus; and it will, in its turn, contribute to ſupination, though in a leſs degree than the others.

CI. INDICATOR.—The EXTENSOR INDICIS PROPRIUS has very nearly the ſame origin, and exactly the ſame courſe with the laſt, and lies by the ſide of it.

Its origin is from the ulna, by the ſide of the extenſor longus pollicis. It has alſo ſome little attachments to the interoſſeous membrane. It, like the others, is feathered with fibres in an oblique direction down to the ligament of the wriſt.

This muſcle lies under the extenſor communis digitorum; its tendon paſſes along with the common tendon, through the annular ligament; and near the top of the metacarpal bone, or about the place of the common junctions of all theſe tendons, this one joins with the indicator tendon of the common extenſor.

Its uſe is to extend all the three joints of the fore-finger, aſſiſting the common extenſor to point with that finger, to act independently of the common extenſor, and to help to extend the wriſt when the fingers are cloſed.

CII. The SUPINATOR BREVIS is an internal muſcle, which forms, with the muſcles of the thumb, of the fore-finger, and mid-finger, a kind of ſecond layer; and this one lies concealed, much as the pronator quadratus does, on the inner ſide of the fore-arm. It is a ſhort muſcle, but very thick and fleſhy, and of great power.

It ariſes from the outer tubercle of the os humeri, and from the edge of the ulna, and from the interoſſeous ligament: it is then lapped over the radius, and is inſerted into its ridge; ſo that this ſupinator brevis is very directly oppoſed to the pronator teres, the inſertion of the two muſcles almoſt meeting on the edge of the radius. It is almoſt circumſcribed to one uſe, that of performing the rotation of the radius outwards; but perhaps it may alſo have ſome little effect in extending the ulna and in aſſiſting the anconeus.

MUSCLES SEATED ON THE HAND.

Besides thoſe muſcles which bend and extend the fingers, there are other ſmaller ones ſeated on the hand itſelf, which are chiefly for aſſiſting the former, and for quicker motions; but moſt eſpecially for the lateral motions of the thumb and little-finger; and which are therefore named ADDUCTORS, ABDUCTORS, and FLEXORS, of the little-finger and thumb.

That they are chiefly uſeful in aſſiſting and ſtrengthening the larger muſcles, is evident from this, that much power being required for flexion, we find many of theſe ſmaller muſcles added in the palm of the hand; but as there is little power of extenſion needed, little more than what will merely balance the power of the flexors, there are no ſmall muſcles on the back of the hand, the interoſſæi externi excepted, which are chiefly uſeful in ſpreading the fingers.

The ſhort muſcles in the palm of the hand are for bending the thumb, the fore-finger, and the little-finger: and the little-finger and the thumb have each of them three diſtinct muſcles; one to pull the thumb away from the hand, one to bend it, and one to pull it towards the hand, oppoſing it to the reſt of the fingers, and ſo of the little-finger, which has alſo three muſcles.

ARRANGEMENT OF THESE MUSCLES.

1. Lumbricales, which bend all the fingers.

2. { ABDUCTOR POLLICIS,
FLEXOR AND OPPONENS POLLICIS,
ADDUCTOR POLLICIS, } bending the thumb and carrying it away from the other fingers, or towards the palm of the hand.

3.	ABDUCTOR INDICIS,	which carries the fore-finger towards the thumb.
4.	ABDUCTOR MINIMI DIGITI, ADDUCTOR MINIMI DIGITI, FLEXOR MINIMI DIGITI,	which bend the little finger, and carry it like the thumb outwards or inwards.
5.	INTEROSSÆI,	which are ſmall muſcles, lying betwixt the metacarpal bones, and aſſiſting the lumbricales in bending the fingers.

All the muſcles of the thumb are ſeated on the inſide, to form the great ball of the thumb; and it is not eaſy at firſt to conceive how muſcles, having ſo much the ſame place, ſhould perform ſuch oppoſite motions; yet it is eaſily explained by the ſlight variation of their places; for the ABDUCTOR ariſes from the annular ligament near the radius, and goes towards the back of the thumb. The FLEXOR ariſes deeper from bones of the carpus, and from the inſide of the ligament, and goes to the inſide of the thumb. The ADDUCTOR ariſes from the metacarpal of the mid-finger, and goes to the inner edge of the thumb.

CIII. The ABDUCTOR POLLICIS is covered only by the common integuments. It begins a little tendinous from the outſide of the annular ligament, juſt under the thumb, and by ſome little fibres from the os ſcaphoides; and from the tendon of the long abductor or extenſor primus, it bends gradually round the thumb, and is at laſt inſerted in the back of the firſt joint, juſt above the head of the metacarpal bone.

But it does not ſtop here; for this flat tendon is now expanded into the form of a faſcia, which, ſurrounding the firſt bone of the thumb, goes forward upon its back part, quite to the end, along with the common tendon of the extenſor. This muſcle, like the others, is covered by a thin expanſion from the tendon of the palmaris, as well as by the common integuments.

Its only uſe is to pull the thumb from the fingers, and to extend the ſecond bone upon the firſt.

Albinus deſcribes a ſecond muſcle of the ſame name, having the ſame courſe, origin, inſertion, and uſe: It alſo ariſes from the outer ſide of the ligament of the wriſt, and is fixed into the ſide of the thumb, and lies upon the inſide of the former muſcle.

Theſe two are inſerted into the firſt bone of the thumb; but the next is inſerted into the metacarpal bone.

CIV. The OPPONENS POLLICIS, is often called the metacarpal of the thumb. It is placed on the inſide, and implanted into the ſide of the thumb: Its office is to draw the thumb acroſs the other fingers, as in clenching the fiſt; and from its thus oppoſing the fingers, it has its name of opponens.

It lies immediately under the laſt deſcribed muſcle, and is like it in all but its inſertion.

It ariſes from the os ſcaphoides, and from the ligament of the wriſt. It is inſerted into the edge and fore part of the metacarpal bone of the thumb: and its uſe is to turn the metacarpal bone upon its axis, and to oppoſe the fingers; or, in other words, to bend the thumb: for I can make no diſtinction. Therefore

fore this muſcle and the next, which lies cloſe upon it, may be fairly conſidered as but two different heads of one thick ſhort muſcle.

CV. The FLEXOR BREVIS POLLICIS is a two-headed muſcle, placed quite on the inſide of the thumb, betwixt the fore-finger and the thumb, and extends obliquely acroſs the two firſt metacarpal bones. It is divided into two heads by the long flexor of the thumb.

The edge of this muſcle lies in cloſe contact with the edge of the laſt, or opponens; and indeed they may fairly be conſidered as one large muſcle ſurrounding the baſis of the thumb.

One head ariſes from the os trapezium or baſe of the thumb, and from the ligament of the wriſt. The other head comes from the os magnum, from many of the other bones of the carpus, and from the ligaments which unite them.

The firſt head is the ſmaller one; it terminates by a pretty conſiderable tendon in the firſt ſeſamoid bone. The ſecond head runs the ſame courſe: it is implanted chiefly in the ſecond ſeſamoid bone, and alſo into the edge of the firſt bone of the thumb cloſe by it. The ſecond head is exceedingly muſcular and ſtrong: the heads are completely ſeparated from each other by the tendon of the flexor longus paſſing betwixt them.

The office of this muſcle is to bend the firſt joint upon the ſecond, and the metacarpal bone upon the carpus: and indeed the office of this, and of the opponens, is the ſame. It is in the tendons of this double-headed muſcle that the ſeſamoid bones are found.

CVI. The

CVI. The ADDUCTOR POLLICIS ariſes from the metacarpal bone of the middle-finger, where it has a flat extended baſe. It goes from this directly acroſs the metacarpal bone of the fore-finger to meet the thumb. It is of a triangular ſhape, and flat: Its baſe is at the metacarpal bone; its apex is at the thumb: It is inſerted into the lower part or root of the firſt phalanx: Its edge ranges with the edge of the flexor brevis: It concurs with it in office; and its more peculiar uſe is to draw the thumb towards the fore-finger, as in pinching.

Thus do theſe muſcles, covering the root of the thumb, form that large and convex ball of fleſh which acts ſo ſtrongly in almoſt every thing we do with the hand. The ball of the thumb is fairly ſurrounded: it is almoſt one maſs, having one office: but as the deltoides will, in ſome circumſtances, pull the arm downwards, ſome portions of this fleſhy maſs pull the thumb outwards obliquely; ſome directly inwards: but the great maſs of muſcle bends the thumb, and oppoſes it to the hand; and as this one muſcle is to oppoſe the whole hand, the ball of fleſh is very powerful and thick.

The ſhort muſcles of the little-finger ſurround its root, juſt as thoſe of the thumb ſurround its ball.

CVII. The ABDUCTOR MINIMI DIGITI is a thin fleſhy muſcle, which forms the cuſhion on the lower edge of the hand, juſt under the little-finger. It is an external muſcle: It ariſes from the os piſiforme, and from the outer end of the annular ligament. It is inſerted laterally into the firſt bone of the little-finger;

but a production of it ſtill goes forward to the ſecond bone of the little-finger.

Its uſe is to ſpread the little-finger ſidewiſe, and perhaps to aſſiſt the flexors.

CVIII. The FLEXOR PARVUS MINIMI DIGITI is a ſmall thin muſcle which riſes by the ſide of the laſt, and runs the ſame courſe, with nearly the ſame inſertion.

Its origin is from the ligament of the wriſt, and in part from the crooked proceſs of the cuneiform bone. Its uſe is to bend the little-finger. And indeed the office and place of both is ſo much the ſame, that I have marked the laſt as a flexor; and the little difference there is, is only that this performs a more direct flexion.

CIX. The ADDUCTOR MINIMI DIGITI is ſometimes called the metacarpal of the little-finger. It lies immediately under the former muſcle. Its origin is from the hook of the cuneiform bone and the adjoining part of the carpal ligament.

It is inſerted into the outſide of the metacarpal bone, which it reaches by turning round it. Its uſe is to put the little-finger antagoniſt to the others: it is to this finger what the opponens is to the thumb. It alſo, by thus bending one bone of the metacarpus, affects the whole, increaſes the hollow and external convexity of the carpus, and forms what is called Diogenes's cup.

CX. The ABDUCTOR INDICIS is a flat muſcle of conſiderable breadth, lying behind the adductor pollicis, and exactly reſembling it, being like the ſecond layer. It ariſes from the os trapezium, and from the firſt bone of the thumb; and it is inſerted into the back part of the firſt bone of the finger, and pulls the fore-finger towards the thumb.

The interoſſei are ſituated betwixt the metacarpal bones. They are ſmall, round, and neat, ſomething like the lumbricales in ſhape and ſize. Three are found in the palm, which bend the fingers, and draw their edges a little towards the thumb; four are found on the back of the hand, for extending the fingers.

CXI. The INTEROSSEI INTERNI ariſe from betwixt the metacarpal bones. They are alſo attached to the ſides of theſe bones. They ſend their tendons twiſting round the ſides to the backs of theſe bones; and they are inſerted along with the tendons of the lumbricales and extenſors into the back of the finger. They are thus flexors of the firſt joint, and extenſors of the ſecond joint, as the lumbricales are.

CXII. The INTEROSSEI EXTERNI are four in number. They ariſe, like the interni, from the metacarpal bones and their interſtices, and from the ligaments of the carpal bones. They are peculiar in having each two heads, therefore named interoſſei bicipites. They join their tendons to thoſe of the extenſor and lumbricales: they have therefore one common office with them; that is, extending all the joints of the fingers. Many have choſen to deſcribe the origin and inſertion with moſt particular care, marking the degree of obliquity, and aſcertaining preciſely their office, and giving particular names to each, as prior indicis for the firſt external; all which I forbear mentioning, becauſe they muſt be more liable to perplex than likely to aſſiſt the ſtudent: if we but remember their common place and office, it is enough. The tendons of the flexor muſcles bend round the finger, along with the interoſſei and lumbricales, for a ſurer hold; conſequently ly the tendons of the long flexors, of the lumbricales, of the interoſſei interni, of the extenſors, and of the interoſſei externi, meet upon the backs of the fingers; which are by them covered with a very ſtrong web of tendinous fibres.

CHAP. IV.

MUSCLES OF RESPIRATION; OR, OF THE RIBS.

The whole back is clothed with ſtrong muſcles; and all its holes, irregularities, and ſpines, are croſſed with many ſmaller ones. Theſe muſcles are related either to the arm, to the ribs, or to the ſpine, i. e. the vertebræ, whoſe motions they perform; and from this we obtain an arrangement not inconſiſtent with the regular order of their office, and yet correſponding with the beſt order of diſſection.

The firſt or uppermoſt layer of muſcles, viz. the trapezius, the muſculus patientiæ, the rhomboides, the latiſſimus dorſi, belong to the arm. The ſerrated muſcles, which lie next under theſe, are the muſcles of reſpiration, and belong to the ribs: while the ſplenius and complexus, the muſcles of the neck, the longiſſimus dorſi, ſacro lumbalis, and the quadratus lumborum, which are muſcles of the back, and the innumerable ſmaller muſcles which lie betwixt the vertebræ, belong entirely to the ſpine.

Reſpiration is indeed performed chiefly by the muſcles of the belly, that is, in ordinary and eaſy breathing. In high breathing, the difficulty is relieved by the co-operation of almoſt all the muſcles of the trunk; of which there is ſcarcely one that may not aſſiſt in ſome ſlight degree. But yet the muſcles of the abdomen have many other offices. And the muſcles of the ſpine, and of the ſcapula, again, belong properly to the arm and trunk; and therefore I call thoſe the muſcles of reſpiration by which the ribs are moved in breathing, and which have no direct relation to almoſt any other motion but merely that of the ribs.

The muſcles which are appropriated to the ribs, performing no other motion, are,

1. The SERRATUS POSTICUS SUPERIOR,	which comes from the neck, and lies fleſhy over the ribs, to pull them upwards.
2. The SERRATUS INFERIOR POSTICUS,	which comes from the lumbar vertebræ, and lies flat on the lower part of the back, to pull the ribs downwards.
3. The LEVATORES COSTARUM,	which are twelve flat muſcles, ariſing from the tranſverſe proceſs of each vertebra, and going down to the rib below, they raiſe the ribs.

4. The

4. The INTERCOSTAL MUSCLES,	which lie betwixt the ribs, and fill up all the ſpace betwixt rib and rib; they alſo raiſe the ribs.

And there may be added to theſe, that muſcle which, lying under the ſternum and within the thorax, is called triangularis ſterni, and pulls the ribs downwards.

CXIII. The SERRATUS SUPERIOR POSTICUS lies flat upon the ſide of the neck, under the trapezius and rhomboides, and over the ſplenius and complexus muſcles. It ariſes by a flat and ſhining tendon from the ſpines of the three lower vertebræ of the neck and the two uppermoſt of the back. It goes obliquely downwards under the upper corner of the ſcapula, and is inſerted into the ſecond, third, and fourth ribs, by three neat fleſhy tongues.

The ligamentum nuchæ is chiefly formed by the meeting of the trapezii muſcles; and the flat tendons of theſe upper ſerrated muſcles help to form it.

They are purely levators of the ribs: their effect upon the vertebra, if they have any, muſt be very ſlight.

CXIV. The SERRATUS INFERIOR POSTICUS is a very broad, thin, muſcle, ſituated at the lower part of the back, under the latiſſimus dorſi, but above the longiſſimus dorſi muſcle.

It ariſes in common with the latiſſimus dorſi, from the ſpines of the two or three lower vertebræ of the back, and the three or four uppermoſt vertebræ of the loins. Their origin, like that of the latiſſimus, is by a thin tendinous expanſion: it ſoon becomes fleſhy, and, dividing into three, ſometimes four, fleſhy ſtraps or tongues, each of them is inſerted ſeparately into the ninth, tenth, eleventh, and twelfth lower ribs, near their cartilages. So that this muſcle, ſpreading ſo wide out from the centre of motion, has vaſt power; for it has the whole length of the rib as a lever.

Its office is to pull the ribs downwards and backwards; the effect of which muſt be to compreſs the cheſt, and in certain circumſtances to turn the ſpine.

CXV. The LEVATORES COSTARUM are twelve muſcles on each ſide, for the direct purpoſe of lifting the ribs; they lie above or upon the ribs, at their angles, and are thence named by ſome SUPRA COSTALES.

They are almoſt a portion of the external intercoſtal muſcles. The firſt of the levators ariſes from the tranſverſe proceſs of the laſt vertebra of the neck, and goes down to be inſerted into the firſt rib, near its tuberoſity; and ſo all that follow ariſe from a tranſverſe proceſs, and go to the rib below, being very ſmall and tendinous at either end. But the three laſt levators ariſe from the ſecond proceſs above the rib to which they belong. They paſs one rib to go into the one below it: they are conſequently twice as long as the nine firſt are; and are therefore named LEVATORES COSTARUM LONGIORES from the ninth downwards.

Thus the levatores coſtarum are a ſucceſſion of ſmall muſcles, ariſing from the tranſverſe proceſſes of the vertebræ, and going to the angles of the ribs; beginning from the laſt vertebra of the neck, and ending with the laſt but one of the back. They lie under the longiſſimus dorſi and ſacro-lumbalis; and often they have connections with theſe muſcles, ſometimes very cloſe.

CXVI. The INTERCOSTALES are two rows of muſcles which lie betwixt the ribs: one row is external, the other internal. The EXTERNAL INTERCOSTALS run from the ſpine towards the ſternum, having their fibres directed from behind forwards, and ſtopping at the cartilages of the ribs. The INTERNAL, again, begin from the ſternum, and go towards the ſpine; they have their fibres directed backwards, and they ſtop at the angle of the ribs; the reaſon for which might be given, were it worth our while to ſtop for an explanation.

Theſe two rows were thought to antagonize each other; the one to pull the ribs downwards, the other to raiſe them. But I ſhall not ſtop to explain this, nor to refute it; it is ſufficient to declare their true uſe, which is (both external and internal) to raiſe the ribs and aſſiſt inſpiration *.

The ninth, tenth, eleventh, and twelfth ribs, have a freer motion; and it appears to me that this is the true uſe of the levatores longiores; and for the ſame reaſon we find, that from the ſixth rib and downwards there are certain ſlips of the internal intercoſtals, which paſs over one rib and go to the ſecond below; and as the levatores longiores were called ſupra-coſtales, theſe have been named INFRA-COSTALES, and COSTARUM DEPRESSORES PROPRII. They were diſcovered by Verhein, and bear his name: they were explained as depreſſors of the ribs by Haller; but they are little different from the intercoſtals in form, and not at all in

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* I remember, many years ago, to have heard Dr Monro explain the office of the intercoſtal muſcles by a diagram, deducing from that argument, the more powerful effect of all muſcles having oblique fibres.

in office, for they raiſe the ribs along with the intercoſtal muſcles.

CXVII. The TRIANGULARIS STERNI, OR STERNO COSTALIS, is a depreſſor of the ribs; an internal muſcle lying chiefly on the inner face of the ſternum, and on the cartilages of the ribs. It is very generally conſidered as a triangular muſcle on each ſide, but ſome conſider it as three or four muſcles under the title of ſterno-coſtales.

There are four ſlips lying on the cartilages of the third, fourth, fifth, and ſixth ribs. The lower portion of the triangularis ariſes from the enſiform cartilage, and is inſerted into the third or fourth rib; the third ariſes from the middle of the ſternum, and goes off from the edges of that bone to be inſerted into the third rib.

The fourth or uppermoſt portion is often awanting; it goes off in part alſo from the inner ſurface of the ſternum, but more commonly from the third rib, and goes to the ſecond rib.

In a dog they are much larger than in a man. Their office is to depreſs the ribs. And theſe portions are all conjoined at their roots, which gives the whole muſcle the triangular ſhape.

The true uſes of the intercoſtales, ſubcoſtales, and triangularis ſterni, have been diſputed; but if the firſt rib be more fixed than the other ribs, then the intercoſtals proceeding downwards from the firſt rib muſt raiſe all the thorax; and if the ſternum be more fixed than the ribs, then the ſterno-coſtales muſcles going upwards from the ſternum muſt pull down the ribs.

CHAP. V.

MUSCLES OF THE HEAD, NECK, AND TRUNK.

MUSCLES OF THE HEAD AND NECK.

The ſerratus ſuperior poſticus being raiſed, the ſplenii come into view; and the ſplenii being alſo lifted, the complexus is fully expoſed.

CXVIII. Splenius.—The two ſplenii are ſo named from their lying like ſurgical ſplints along the ſide of the neck; both together they have the appearance of the letter Y; the complexus being ſeen betwixt them in the upper part of the angle. They lie immediately under the trapezii, and above the complexi.

Each ſplenius is a flat and broad muſcle, which ariſes from the ſpinous proceſſes of the neck and back, and is implanted into the back part of the head. It ariſes from the four ſpines of the back and the five lower of the neck; it parts from its fellow at the fifth vertebra of the neck, ſo as to ſhow in the interſtice two or three of the uppermoſt ſpines of the neck, with the upper part of the complexus muſcle: each ſplenius goes obliquely outwards, to be inſerted into the occipital ridge, and all along to the root of the maſtoid proceſs. At the third vertebra of the neck, where the two ſplenii muſcles part from each other, the tendons of the oppoſite ſplenii are cloſely connected both with each other, and with the common tendon, which is called ligamentum nuchæ.

This is the SPLENIUS CAPITIS; but there is a portion of this ſame muſcle which lies under this, and which has the ſame common origin, but which terminates by four or five diſtinct tendons in the tranſverſe proceſſes of the upper vertebra of the neck. This portion may be diſſected apart; and has been conſidered by many as a muſcle, the SPLENIUS COLLI of Albinus; who has diſtinguiſhed as ſplenius capitis all that part ariſing from the ſpines of the neck, and implanted into the head; and as the ſplenius colli, all that part which ariſes from the vertebræ of the back, and is implanted into the tranſverſe proceſſes of the neck.

Theſe ſplenii are the proper antagoniſts of the maſtoid muſcles. Both the ſplenii acting, pull the head directly backwards; one acting turns the head and neck obliquely to one ſide; one acting along with the correſponding maſtoid muſcle, lays the ear down upon the ſhoulder.

CXIX. The COMPLEXUS is named from the intricacy of its muſcular and tendinous parts, which are mixed; from the irregularity of its origins, which are very wide, it has the names of COMPLEXUS-IMPLICATUS-TRIGEMINUS, by which the ſtudent is warned of the difficulty of underſtanding this muſcle.

It lies immediately under the ſplenius; ariſes by diſtinct tendons, with ten or more tendinous feet, from the tranſverſe proceſſes of the neck and back, from the four lower vertebræ of the neck, and from the ſeven uppermoſt of the back; having alſo ſome leſs regular origins, as from two ſpines of the back, and from four oblique proceſſes in the neck. It grows into a large muſcle, which is not like the ſplenius, flat and regular, but thick, fleſhy, compoſed of tendon and fleſh mixed; filling up the hollow by the ſides of the ſpines of the neck, and terminating in a broad fleſhy head, which is fixed under the ridge of the occipital bone; and this is the part which is ſeen in the angle or forking of the ſplenii.

This may ſtand as the general deſcription of the muſcle conſidered as one: but Albinus has choſen to deſcribe it as two muſcles, under two different names, with a minuteneſs which, far from clearing the demonſtration of any difficulties, makes it leſs diſtinct; and, if any thing could complete the confuſion, it was his humour of calling that BIVENTER which had been hitherto named COMPLEXUS, and naming the lower part of the muſcle COMPLEXUS, though it never had been diſtinguiſhed from the reſt.

The BIVENTER of ALBINUS is the upper layer of the muſcle, that part which appears in the fork of the ſplenii: And if we have hitherto named it complexus, from its mixture of tendons and fleſh, it is particularly improper to transfer that name to another part of the muſcle which is leſs complicated. This upper layer, the BIVENTER CERVCIS, ariſes by a large broad head from the occipital bone. In the centre of this belly there is a confuſion of tendon; then there is a middle tendon, about the middle of the arch of the neck; and the lower part of the biventer ariſes from two parts; firſt, by one ſlip of fleſh from the two uppermoſt ſpines of the back; and, ſecondly, by a larger fleſhy portion which comes from the fourth, fifth, ſixth, and ſeventh tranſverſe proceſſes of the back. And it is from the upper and lower fleſhy heads, and the confuſed middle tendon, that it is called biventer.

The COMPLEXUS of ALBINUS lies below this one. It ariſes by three tendinous and fleſhy ſlips from the three upper tranverſe proceſſes of the back : then it has four other ſlips from four oblique or articulating proceſſes of the neck; which various origins are gathered into one thick irregular fleſhy belly, which is implanted into the occiput under the great head of the biventer, and mixed with it. This I have choſen to explain, leſt the ſtudent ſhould be embarraſſed by falſe names; referring him to the firſt paragraph for the true and ſimple deſcription of this muſcle.

CXX. TRACHELO-MASTOIDEUS *.—The laſt muſcle is often named COMPLEXUS MAJOR, and this COMPLEXUS MINOR; but a fitter name is the TRACHELO-MASTOIDEUS, from its origin in the neck and its inſertion in the maſtoid proceſs.

It has exactly, or nearly, the ſame origin and the ſame inſertion with the ſplenius; for it ariſes, not from the ſpines indeed, but from the tranſverſe proceſſes of the back and neck, and is implanted into the maſtoid proceſs.

Its origin is from the three firſt vertebræ of the back, and from the five loweſt of the neck at their tranſverſe proceſſes. Its origins are by diſtinct tendons, and its belly is in ſome degree mixed of tendon and fleſh; whence its name of complexus minor. It is inſerted into the maſtoid proceſs, juſt under the inſertion of the occipital part of the ſplenius : and indeed its long and flat belly lies all along under that muſcle,

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* It is the TRACHELO-MASTOIDEUS, the MASTOIDEUS LATERALIS, the CAPITIS PARTERTIUS, the COMPLEXUS MINOR : by ſome it is conſidered as a part of the COMPLEXUS.

muſcle, ſo that the order is this: 1. The TRAPEZIUS; 2. The SPLENIUS CAPITIS; 3. The SPLENIUS CERVICIS; 4. The TRACHELO-MASTOIDEUS.

It is needleſs to ſpeak of its uſe, ſince the uſe of all theſe muſcles is to draw the head backwards directly, when both act; obliquely, when one acts alone.

The RECTI MUSCLES are two deep-ſeated muſcles, which go immediately from the vertebræ to the occiput to be inſerted into its lower ridge. They are called major and minor.

CXXI. The RECTUS MINOR is the ſhorter of the two, ariſing from the firſt vertebra of the neck. Its place of origin is a ſmall tuber which ſtands in the place of the tranverſe proceſs of the firſt vertebra; and from that point where it is tendinous, it goes up to the occipital ridge, and is inſerted fleſhy.

CXXII. The RECTUS MAJOR is larger. It ariſes, in like manner, tendinous, from the ſecond vertebra of the neck at its tranſverſe proceſs, and mounting from that, is inſerted fleſhy into the lower ridge of the occiput without the former. Theſe are ſo placed, that the recti minores appear in the interſtice of the recti majores. And though we call them both recti, yet they cannot truly be ſo; for the recti minores muſt be, in ſome degree, oblique, and the recti majores ſtill more ſo: and conſequently, although their chief uſe be conjointly to draw the head directly backwards, yet one acting muſt turn the head to its ſide. And indeed the ſame may be ſaid of all the muſcles of the neck; for they are all divided by the ſpine, and conſequently they are all oblique.

The OBLIQUUS SUPERIOR and OBLIQUUS INFERIOR correſpond very cloſely in all things with the recti; but in their oblique direction the uppermoſt, as being much ſhorter, has been named obliquus minor, the lower one obliquus major.

CXXIII. The OBLIQUUS SUPERIOR ariſes from the tranſverſe proceſs of the atlas, and is inſerted into the end of the lower occipital ridge. Its uſe, notwithſtanding it oblique poſition, is not to turn, but to bend, the head backwards; for the occipital condyles are not concentric circles. Its inſertion into the occiput is under the ſplenius and complexus; but one edge of it is above the inſertion of the rectus major.

CXXIV. The OBLIQUUS INFERIOR riſes from one vertebra and goes to another. It ariſes from the ſpine of the ſecond vertebra: it goes to the tranſverſe proceſs of the firſt; and it meets the ſuperior oblique muſcle; and, by the long lever or arm of the firſt vertebra, obtains great power. The firſt vertebra or atlas rolls on the tooth-like proceſs of the dentatus; and while the great and ſlow motions of the neck in general are performed by other muſcles, the ſhort and quick turnings of the head are performed entirely by theſe oblique muſcles.

MUSCLES OF THE TRUNK.

THE great muſcles which move the back and loins are the QUADRATUS LUMBORUM, SACRO LUMBALIS, and LONGISSIMUS DORSI.

The ſacro lumbalis and longiſſimus dorſi lie immediately under the latiſſimus dorſi, which is the outer layer; the quadratus lumborum lies again under theſe, and next to the abdominal muſcles; and, laſtly, the abdominal muſcles are the innermoſt layer, and make the back part of the walls of the abdomen. Although the quadratus lumborum lies deep under the longiſſimus dorſi muſcle, I ſhall deſcribe it firſt for the ſake of a connection which will be preſently underſtood.

CXXV. The QUADRATUS LUMBORUM is a flat ſquared muſcle, named quadratus from its ſquare or rather oblong form. It ariſes fleſhy from three or four inches of the back part of the os ilium, and from the ligaments of the pelvis, which tie the back part of the ilium to the ſide of the ſacrum and to the tranſverſe proceſſes of the loins. As it goes upwards along the ſide of the lumbar vertebræ, it takes hold of the points of the tranſverſe proceſſes of each by ſmall tendinous ſlips; ſo that we are almoſt at a loſs whether to conſider theſe as new origins or as inſertions: but its chief inſertion is into the lower edge of the laſt rib, and a ſmall production of it ſlips under the arch of the diaphragm, to be implanted into the body or fore part of the laſt verterbra of the back.

The LONGISSIMUS DORSI and SACRO LUMBALIS have their origin in one common and broad tendon, coming from the ſacrum, ilium, and loins; the two muſcles lie along ſide of each other; the longiſſimus dorſi is nearer the ſpine, and keeps its tendons cloſer by the ſpine. The ſacro lumbalis is farther from the ſpine, and ſpreads its tendinous feet broader upon the ſides of the thorax; and if one be a little under the other, it is the outer edge of the longiſſimus dorſi, which is a little under the edge of the lumbar muſcle.

The common tendon and muſcle (for there is for ſome way but one muſcle) begins thus: It may be ſaid to have two kinds of adheſion; for, firſt, externally it appears a broad, flat, and ſhining tendon, which ariſes tendinous from all the ſpines of the lumbar vertebræ, from the ſpines of the ſacrum, and from the back part of the os ilium. But the inner ſurface of this broad tendon is ſtrongly fleſhy; for it ariſes fleſhy from the back part of the ilium, from the deep hollow betwixt the ilium and ſacrum, from the ſides of the long ſpines of the lumbar vertebræ, and from their articulating proceſſes and the roots of their tranſverſe proceſſes. In ſhort, its origin is all tendinous without, and all fleſhy within; and its fleſh ariſes from all that irregular ſurface which is on either ſide of the ſpine, betwixt the os ilium and the vertebræ of the loins; and thus it continues one ſtrong tendinous and fleſhy muſcle, filling up all the hollow of the loins. There is an appearance of ſeparation, ſomething like a ſplit in the tendon, which ſhows in the loins what part of the tendon belongs to each muſcle; but it is only in the back that they are fairly divided.

Juſt oppoſite to the loweſt rib, the longiſſimus dorſi and ſacro lumbalis break off from the common tendon; and the longiſſimus goes to be implanted into the vertebræ, and the ſacro lumbalis to be implanted into the ribs.

CXXVI. The LONGISSIMUS DORSI is a muſcle of the ſpine. It is not a flat muſcle, but round, thick, and firm, filling up all the hollow betwixt the ſpine and the angle of the ribs. It is of a long form, as its name implies, terminating towards its top almoſt in a point. It has two diſtinct ſets of feet by which it is inſerted;

ſerted; one ſet of feet more fleſhy, but ſmall and neat, go outwards from the ſide as it were of the muſcle, to be implanted near the heads of the ribs; the lower ones farther out than the heads of the ribs; the upper ones cloſe to the head, and conſequently cloſer to the ſpine. Theſe heads are nine or ten in number, correſponding with the nine or ten uppermoſt ribs. Another ſet of heads, which are not ſo well ſeen as this ſet, becauſe they lie more under the muſcle, are ſmall, neat, and tendinous; they go in an oppoſite direction, viz. inwards and upwards; keep cloſer by the ſpine, and are inſerted into the tranſverſe proceſſes of the vertebræ of the back. This ſet of heads is thirteen in number, implanted into the tranſverſe proceſſes of all the back, and of one vertebra of the neck.

CXXVII. The SACRO LUMBALIS ſeparates from the longiſſimus dorſi at the laſt rib, and is a flatter and leſs fleſhy muſcle: its twelve tendons are flatter than thoſe of the longiſſimus dorſi, and go out wider from the ſpine. The tendons next to the longiſſimus dorſi run higheſt up, and are the longeſt; thoſe fartheſt from the ſpine, i. e. fartheſt out upon the cheſt, are the ſhorteſt. It has a flat tendon for each rib, which takes hold upon the lower edge of the rib. But it has another order of ſmall muſcles which mix with it: for as the longiſſimus dorſi has a double row of inſertion, this has another ſet of attachments; for there ariſes from the ſurface of each rib, at leaſt of the ſix or ſeven loweſt ribs, a ſmall ſlip of fleſh, which runs into the ſubſtance of the ſacro lumbalis, and mixes with it; and theſe fleſhy ſlips go by the name of the ADDITAMENTUM AD SACRO-LUMBALEM, OR MUSCULI ACCESSORII.

Both theſe muſcles, viz. the longiſſimus and ſacro-lumbalis, terminate in points which reach towards the neck; and under the point of each there lie the roots of two ſmall muſcles, which go up to move the neck. Many have referred theſe ſlips going up into the neck entirely to the muſcles I am now deſcribing; calling one an aſcending ſlip of the longiſſimus dorſi, and the other a ſlip of the ſacro-lumbalis; while others have deſcribed them as diſtinct muſcles, having but ſlight connections with the longiſſimus and ſacro-lumbalis. Their proper names are CERVICALIS DESCENDENS, and TRANSVERSALIS COLLI.

CXXVIII. The CERVICALIS DESCENDENS is connected with the ſacro-lumbalis muſcle; it cannot be entirely referred to it, for the cervicalis deſcendens ariſes as a diſtinct muſcle from the five lower vertebræ of the neck at their tranſverſe proceſſes; goes downwards very ſmall and ſlender to be inſerted into the ſix uppermoſt ribs, to get at which it ſlips under the longeſt tendons of the ſacro-lumbalis; but that the cervicalis deſcendens does not belong to the ſacro-lumbalis, may be inferred from its having diſtinct tendons from ſix ribs, and from ſix tranſverſe proceſſes of the neck, and from theſe tendons being in a direction which does not at all correſpond with the heads of the ſacro-lumbalis. Indeed the longiſſimus dorſi has a better claim to this muſcle; for a long ſlip, partly tendinous and partly fleſhy, runs upwards from the longeſt tendon of the longiſſimus dorſi, to join itſelf to the cervicalis deſcendens. *

CXXIX. The

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* Hence it is plain that the ſacro-lumbalis and longiſſimus dorſi have nearly an equal claim to this cervicalis deſcendens. For, firſt, the

CXXIX. The TRANSVERSALIS COLLI is that which Sabbatier refers to the longiſſimus dorſi; but it is a diſtinct muſcle, ariſing partly tendinous and partly fleſhy from the five upper tranſverſe proceſſes of the back; lies betwixt the trachelo maſtoideus and the cervicalis deſcendens; goes from the tranſverſe proceſſes of the back to the tranſverſe proceſſes of the neck, and has no more than a confuſed and irregular connection with any other muſcle.

The QUADRATUS LUMBORUM keeps the trunk erect by the action of both muſcles at once; inclines it to one ſide, or turns it upon its axis, when one only acts; and by its inſertion into the ribs muſt aſſiſt in high breathing, by pulling down the ribs. The LONGISSIMUS DORSI has no power but over the ſpine, which it bends backwards, acting continually in keeping the trunk erect. This is alſo the chief uſe of the ſacro-lumbalis; but the SACRO-LUMBALIS going out further upon the ribs, takes ſuch hold upon them, that beſides its common action of raiſing the trunk, it may, on occaſions, pull them down, aſſiſting the quadratus and the lower ſerrated muſcle. And it will have greater power in turning the trunk of the body upon its axis than the longiſſimus dorſi, which pulls almoſt directly backwards. The CERVICALIS DESCENDENS co-operates with the trachelo maſtoideus and others, which turn the

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the longiſſimus dorſi ſends its longeſt tendon fairly up into the cervicalis deſcendens ſo far, that the ſlip is implanted into the tranſverſe proceſſes of the neck. And, ſecondly, the feet of the cervicalis deſcendens begin under the laſt tendons of the ſacro-lumbalis, ſo as to have the appearance of ariſing from its ſupplementary muſcle, the additamentum, and being a part of it; and indeed Sabbatier has deſcribed it according to this view.

the head to one ſide; and the cervicalis deſcendens bends the neck to one ſide; both the one and the other being independent muſcles, and having no further connection with each other than what ariſes from the confuſion of the parts.

Theſe two muſcles bring us to mention that intricate ſet of muſcles which fills up all the hollows and interſtices among the ſpines and irregular proceſſes of the vertebræ, which might be fairly reckoned as one muſcle, ſince they are one in place and in office; but which the anatomiſt may ſeparate into an infinite number, with various and perplexing names; an opportunity which anatomiſts have been careful not to loſe.

The ſurface of the back, from the bulge of the ribs on one ſide to the bulge of the ribs on the oppoſite ſide of the thorax, is one confuſed ſurface; conſiſting of innumerable hollows, proceſſes, and points of bone; and it is tied from point to point with innumerable ſmall muſcles, or unequal bundles of mixed tendon and fleſh. There are many points; as the ſpinous, tranſverſe, and oblique proceſſes of the vertebræ, and the bulging heads and angles of the ribs; and each proceſs, or at leaſt each ſet of proceſſes, has its diſtinct ſets of muſcles and tendons.

1. There is one long continuity of muſcular and tendinous fibres going from ſpine to ſpine, along the whole length of the back and neck. This is divided into the SPINALIS CERVICIS and the SPINALIS DORSI.

2. There is a ſimilar continuation of fibres, with leſs tendon and more fleſh, belonging one half to the ſpine and the other half to the tranſverſe proceſſes, where it is named SEMI-SPINALIS DORSI.

3. There is a great maſs lying all along the hollow of the back, on each ſide of the ſpinous proceſſes, which paſſing alternately from the tranſverſe proceſs of one vertebra to the ſpinous proceſs of the next above, is of courſe ſplit into many heads, but yet having ſuch connection as to give it the form and name of a ſingle muſcle, the MULTIFIDUS SPINÆ.

4. and 5. There are yet ſmaller muſcular faſciculi, which ſtand perpendicularly betwixt every two tranſverſe and every two ſpinous proceſſes; thence they are named INTERTRANSVERSARII and INTER-SPINALES.

CXXX. The SPINALIS CERVICIS is that which is implanted into the ſpines of the cervical vertebræ; but becauſe it does not go from ſpine to ſpine, like the ſpinalis dorſi, but from tranſverſe proceſſes to ſpines, it has been named by Winſlow SEMI-SPINALIS, or TRANSVERSO-SPINALIS COLLI. It ariſes from the tranſverſe proceſſes of the ſix upper vertebræ of the back, and is inſerted into all the ſpinous proceſſes of the vertebræ of the neck except the firſt and laſt; and it extends the neck, or, by its obliquity, may contribute to the turnings of the neck, or to bending it to one ſide†.

CXXXI. The SPINALIS DORSI ariſes from two ſpinous proceſſes of the loins, and from the three lower ſpines of the back; and paſſing two ſpines untouched, it is implanted into all the ſpines of the back except the uppermoſt. This muſcle is very ſlender and long, and conſiſts fully more of tendon than of fleſh: it has five feet below, riſing from the lower ſpines of the back and loins; and nine feet above, implanted into the upper ſpines of the back. Its action muſt raiſe the ſpine; but perhaps it may be equally uſeful as a muſcular and tendinous ligament.

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† The TRANSVERSALIS CERVICIS (vide p. 301.) is that which goes from the tranſverſe proceſſes of the back to the tranſverſe proceſſes of the neck; while this, the SPINALIS CERVICIS, goes from the tranſverſe proceſſes of the back to the ſpines of the neck.

CXXXII. The SEMI-SPINALIS DORSI ariſes from the tranſverſe proceſſes of the lower vertebræ of the back all but two; and is implanted into the upper ſpinous proceſſes of the back, and into the firſt ſpine of the neck*.

CXXXIII. The MULTIFIDUS SPINÆ runs from the ſacrum along all the ſpine to the vertebræ of the neck; and is a comprehenſive and true way of deſcribing many irregular portions of fleſh, which authors have divided into diſtinct muſcles†. It is a continued fleſhy indentation, from tranſverſe proceſs to ſpine, through all the vertebræ of the back, neck, and loins.

It begins both tendinous and fleſhy from the upper convex ſurface of the os ſacrum, which is rough with ſpines from the adjoining part of the ilium; and in the loins it ariſes from oblique proceſſes; in the back, from tranſverſe proceſſes; and again from oblique proceſſes among the cervical vertebræ.

Its origin in the loins is cloſe to the ſpine; being from the upper oblique proceſſes, and from the root of the tranſverſe proceſſes. In the back it ariſes from the tranſverſe proceſſes, and therefore ariſes there by more diſtinct heads. In the neck, again, it ariſes from the lower oblique proceſſes more confuſedly.

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* This is of courſe the TRANSVERSO-SPINALIS DORSI of Winſlow.

† TRANSVERSO-SPINALIS LUMBORUM veterib. SACER; SEMI-SPINALIS INTERNUS, ſive TRANSVERSO-SPINALIS DORSI; SEMI-SPINALIS, ſive TRANSVERSO-SPINALIS COLLI, pars interna.—Winſlow. TRANSVERSALIS LUMBORUM, vulgo SACER; TRANSVERSALIS DORSI; TRANSVERSALIS COLLI.—Douglas.

Its bundles or faſciculi are inſerted into the ſpinous proceſſes; ſometimes into the ſecond, or even into the third or fourth ſpine, above that from which the bundle ariſes; for the tendons do not ſtop at that ſpinous proceſs which they firſt touch, but go upwards, taking attachments to other two or three, and mixing their tendons with thoſe of the faſciculi above and below; and theſe tendons reach from the firſt of the loins to all the vertebræ, up to the atlas, which is the only one not included.

The uſe of the multifidus ſpinæ is to retain the ſpine from being too much bent forwards; for theſe muſcles ſerve (as I have obſerved) the purpoſe of a ligament, and the beſt of all ligaments, having a degree of ſtrength exactly proportioned to the neceſſity for ſtrength. It alſo moves the ſpine backwards, though perhaps it is leſs uſeful in this than as a ligament; for we find it as ſtrong in the vertebræ of the back, which have little motion, and that little very ſlow and general. It ſeems rather intended to moderate the lateral motions of the vertebræ than to produce them: When it acts, its chief uſe is either to reſiſt the ſpine being bent forward by a weight, or to erect the ſpine.

CXXXIV. The INTERSPINALES COLLI, DORSI, and LUMBORUM, have varieties ſo little intereſting that they need hardly be deſcribed. The INTERSPINALES

COLLI are ſtronger, becauſe the neck has many and quick motions, and the bifurcated ſpines of the neck give broader ſurfaces for theſe muſcles. The INTERSPINALES DORSI are almoſt entirely awanting, becauſe the ſpines of the back are cloſe upon each other, and the vertebræ are almoſt fixed. The INTERSPINALES in the LOINS are rather tendons or ligaments than proper muſcles.

CXXXV. The INTERTRANSVERSALES are again ſtronger and fuller in the neck, becauſe of the lateral motions of the neck being free, and its tranſverſe proceſſes forked. They are in more numerous bundles where the motion is greateſt, viz. betwixt the atlas and dentatus; and it is there that Albinus counts his INTERTRANSVERSALES CERVICIS, PRIORES-LATERALES, &c. The inter-tranſverſarii are awanting in the BACK, giving place to the ligaments, by which they are tied to each other and to the ribs; but in the LOINS, the inter-tranſverſarii are again ſtrong, for the lateral or twiſting motions of the loins.

The muſcles on the fore part of the head and neck will complete the catalogue of thoſe belonging to the ſpine, and they are the chief antagoniſts to the muſcles which I have been deſcribing.

CXXXVI. The PLATISMA MYOIDES † is a very thin muſcular expanſion, like the cutaneous muſcle in animals. It is ſpread over the other muſcles immediately under the ſkin, and covers the whole neck and lower part of the face.

It ariſes from the cellular ſubſtance and aponeuroſis,

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† The PLATISMA-MYOIDES is alſo named MUSCULUS CUTANEUS LATISSIMUS COLLI, and QUADRATUS GENÆ.

roſis, which cover the pectoral muſcle, the deltoid muſcle, and the clavicle. Its origin is by long ſeparate fleſhy ſlips; it goes like a thin integument over the neck, and is firſt inſerted about the depreſſor anguli oris; and then going over the maſſeter, is loſt betwixt the muſcles and the integuments of the cheek.

Perhaps it ſerves alſo to pull down the ſkin of the cheek and the angle of the mouth; but its chief inſertion is into the lower jaw, and its uſe to pull it downwards.

CXXXVII. Mastoideus.—This muſcle ariſes partly from the clavicle, partly from the ſternum. Albinus reckons it two muſcles, the STERNO-MASTOIDEUS, and CLEIDO-MASTOIDEUS: a more common name is the STERNO-CLEIDO-MASTOIDEUS: but here, as in other things, I adhere to what is plaineſt. And the moſt familiar and eaſy name is muſculus MASTOIDEUS, conſidering the clavicular portion as an addition only.

Its origin from the upper part of the ſternum is pretty round. It ariſes again flat from the fore part of the clavicle; and this ſecond origin is broad and fleſhy, while the firſt one is tendinous and pointed. Theſe two heads form together a very big, ſtrong, bellied, fleſhy muſcle, which is inſerted into the maſtoid proceſs by a broad tendon, which indeed ſurrounds the maſtoid proceſs, and from that extends ſtill backwards towards the lambdoidal ſuture. When one of the maſtoid muſcles acts, it turns the head to one ſide; when both act, they pull the head directly forwards.

CXXXVIII. Rectus internus capitis major. There are three muſcles on each ſide, lying under the œſophagus, trachea, and great veſſels, flat upon the fore part of the vertebræ; and this is the firſt and longeſt.

Although this be called rectus, it is oblique, and runs rather on one ſide; for it ariſes from the tranſverſe proceſſes of the five lower vertebræ of the neck, and is inſerted into the cuneiform proceſſes of the occipital bone, juſt before the foramen magnum.

CXXXIX. RECTUS INTERNUS MINOR. This is an exceedingly ſmall muſcle; reſembles the obliquus poſterior of the head. It lies immediately under the RECTUS MAJOR: It ariſes from the fore part of the body of the firſt vertebra, the atlas; and going (like the other rectus) obliquely inwards, it is inſerted into the occipital bone near the condyle.

CXL. And the RECTUS CAPITIS LATERALIS is another ſmall muſcle like the former; which ariſes from the tranſverſe proceſſes of the firſt vertebra, and is inſerted into the ſide of the cuneiform proceſs of the occipital bone. It lies immediately under the exit of the great jugular vein.

CXLI. LONGUS COLLI. This is the chief of thoſe muſcles which lie upon the fore part of the neck; it is very long, ariſing from the flat internal ſurface of the vertebræ of the back to go up along thoſe of the neck.

Its origin is firſt within the thorax, from the three uppermoſt vertebræ of the back, from the flat part of their bodies, and then from all the tranſverſe proceſſes of the neck except the three upper ones. It is inſerted tendinous into the fore part of the ſecond vertebra of the neck, where the oppoſite large muſcles meet in one point almoſt *.

All theſe muſcles, which lie thus flat upon the plain ſurface of the vertebræ of the neck, pull the head and neck directly forwards; or when the muſcles of one ſide act, they are of uſe in pulling it towards that ſide; though I rather ſuppoſe that that motion is performed by the external muſcles.

CXLII. The SCALENUS I conſider as one muſcle; for it is one in origin, inſertion, and office. Its origin is from the whole upper ſurface of the firſt rib from its cartilage backwards, and alſo from the ſecond rib; and its inſertion is into the tranſverſe proceſſes of the vertebræ of the neck. But by its broad origin, and its very long inſertion, it gives opportunity for dividing it into ſeveral faſciculi; and accordingly it has been ſo divided: but theſe diviſions are entirely modern, artificial, and unnatural. The ancients conſidered it as one triangular muſcle: Winſlow divided it into two, the primus and ſecundus; Cowper into three; Douglas into four; and Albinus divides it into five muſcles. The ancients called it ſcalenus from its reſemblance to the ſcalen triangle; and the true anatomy is to conſider it as one great triangular muſcle, flat, and ſtretching from the ribs to the neck, cloſing the thorax above, and giving paſſage to the nerves and veſſels of the arm.

If it were to be deſcribed in diſtinct portions, it would be in three parts. The anterior portion ariſes from the tranſverſe proceſſes of the ſix lower vertebræ

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* The longus colli muſcle is in part covered by the rectus major.

bræ of the neck, and is inſerted into the flat part of the firſt rib hard by its cartilage. The middle portion from the four lower vertebræ goes to the outer edge of the rib, and extends along all its length. The poſterior portion is the thinneſt and longeſt; for it ariſes from the tranſverſe proceſſes of the ſecond, third, and fourth vertebræ. It is inſerted into the upper edge of the rib, about an inch or more from its articulation with the ſpine.

The firſt head is tendinous and fleſhy at its inſertion into the rib; but the ſecond and third heads are tendinous both in their origins and inſertions.

The artery goes through the fleſh of the firſt portion, about an inch above the axilla.

The nerves paſs in the interſtice betwixt the firſt and ſecond portions.

The office of the ſcalenus muſcle is to pull the neck to one ſide, or to bend the head and neck forward when both act; and when the neck is fixed backwards, they may perhaps raiſe the ribs; for aſthmatics are obſerved to throw the head backwards, in order to raiſe the cheſt with greater power.

CHAP. VI.

OF THE MUSCLES OF THE ABDOMEN, AND OF THE DIAPHRAGM.

THE abdominal muſcles cover in the belly, contain the bowels, and take a firm hold upon the pelvis and the trunk; the diaphragm, again, is a moving partition betwixt the thorax and the abdomen; and the diaphragm preſſing down the bowels upon the abdominal muſcles, enlarges the thorax, and the abdominal muſcles reacting, puſh the bowels back upon the diaphragm, and compreſs the thorax. Thus the alternate yielding and reaction of the abdominal muſcles and diaphragm performs breathing; agitates the bowels; promotes the circulation; expels the fæces and urine; aſſiſts the womb in the delivery of the child. And, with all theſe important uſes, the abdominal muſcles bend and turn the trunk, and fix it for the ſtronger actions of the limbs. They ſteady the body in lifting weights, in bearing loads, in all our more violent exertions: They often give way under this double office of breathing and of ſtraining along with the reſt of the body; and the bowels coming out through their natural openings, or by burſting through the interſtices of their fibres, form herniæ of various kinds. Whence the anatomy of theſe muſcles is moſt intereſting to the ſurgeon.

The muſcles of the abdomen are five on either ſide. 1. The outer oblique muſcle, to which the names of DESCENDENS, DECLIVIS, and MAJOR, are added, becauſe it is the outermoſt of all the abdominal muſcles; becauſe it is the largeſt, covering all the ſide of the abdomen with its fleſhy belly, and all the fore part of the abdomen with its broad expanded tendon; and it is called declivis, or deſcendens, becauſe its fleſhy belly begins above upon the borders of the thorax; and becauſe both its muſcular and tendinous fibres, which lie parallel to each other, run obliquely from above downwards and inwards.

2. The OBLIQUUS INTERNUS is named from its being within the firſt; and has the names of ASCENDENS vel MINOR ſuperadded, becauſe its fleſhy belly is ſmaller than that of the firſt, ariſes below, chiefly in the haunch-bone, and all its fibres go from below upwards.

3. The TRANSVERSALIS lies under all the others, and next to the cavity of the abdomen, and has but one name, which alſo is derived from the direction of its fibres running acroſs or round the abdomen.

4. The RECTUS, ſo named becauſe of its running on the fore part of the abdomen in one ſtraight line from the pubis to the ſternum.

5. The PYRAMIDAL muſcle is the only one named from its ſhape. It is a ſmall, neat, conical muſcle, which ariſes from the os pubis by a broad baſis, and has its apex turned upwards; but it is not always found,

for it is only as a ſupplement to the recti muſcles and a part of them; whence it has been named MUSCULUS SUCCENTURIATUS, or ſupplementary muſcle.

CXLIII. The EXTERNAL OBLIQUE muſcle ariſes from the ribs, and, like all the others which ariſe from ribs, is a ſerrated muſcle. It comes from the eight lower ribs by diſtinct fleſhy tongues, one from each rib. Theſe ſerræ are mixed with the indentations of the ſerratus major anticus muſcle, which goes off in an oppoſite direction. The origin of the muſcle lies out broad upon the border of the cheſt; it is its thickeſt and moſt fleſhy part, whence its fibres go down all in one direction parallel with each other, but oblique with reſpect to the abdomen. Its fleſhy belly ceaſes about the middle of the ſide. Its flat ſheet of tendon goes over the fore part of the belly till it meets its fellow exactly in the middle; ſo that one half, or the back part of the abdomen, is covered by its fleſhy belly, and the fore part by its tendinous expanſion.

The muſcle meets its fellow in the middle of the belly; and this meeting forms (along with the other tendons) a white line from the pubis to the ſternum, which is named LINEA ALBA. It alſo, before it reaches the middle, adheres to the flat tendon of the inner oblique muſcle. This meeting is about four inches on either ſide of the linea alba, and is a little inclined to the circular, whence it is named linea ſemilunaris. And, finally, this muſcle is implanted into the ſpine of the ilium; fleſhy about the middle of the ilium; tendinous at the fore part or ſpinous proceſs of the ilium; and ſtill tendinous into the whole length of that ligament, which extends from the ſpine of the ilium to the creſt of the pubis.

This is the whole of its inſertion, viz. all the length of the linea alba, from the pubis to the ſternum, the fore part of the ſpine of the ilium, and the ligament of Paupart; which, though it is commonly thought to be but the tendon of the external oblique ſtretching from point to point, is in truth a diſtinct ligament, independent of the tendon, and ſtronger than it.

CXLIV. OBLIQUUS INTERNUS ABDOMINIS.—The chief part of this muſcle ariſes thick and fleſhy from all the circle of the ſpine of the ilium, with its fibres directed upwards. But, to be accurate, we muſt deſcribe it as ariſing from the whole length of the ſpine of the ilium; from the joining of the ilium and ſacrum; from the ſpines of the ſacrum itſelf; and from the three lower ſpinous proceſſes of the loins *; and, laſtly, it ariſes from the ligament of the thigh, at its end next to the ilium; but ſtill the chief belly is at the iliac ſpine. From that it ſpreads upwards in a radiated form; the central fibres only are direct, going acroſs the abdomen to the linea alba; the higher fibres aſcend and go towards the ſternum, and the lower ones go obliquely downwards to the pubis. Its flat tendon is like that of the external oblique; and it is inſerted into the cartilages of all the falſe ribs, into the ſternum, and into the linea alba through its whole length.

CXLV. The TRANSVERSALIS ABDOMINIS runs directly acroſs the belly. It ariſes fleſhy from the inner ſurface of the ſix lower ribs, where its digitations mix with thoſe by which the diaphragm ariſes tendinous;

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* This origin from the ſpinous proceſſes of the loins is a thin tendon common with the ſerratus and latiſſimus dorſi muſcles.

nous; from the tranſverſe proceſſes of the four lower lumbar vertebræ; from the whole ſpine of the os ilium; and from a part of the femoral ligament. Upon the whole, its origin is like that of the inner oblique muſcle; its fibres go acroſs the abdomen, and its tendon is inſerted into the whole length of the linea alba.

The ſucceſſion in which theſe three muſcles ariſe from the cheſt is this: The external oblique muſcle lies broad upon the outſide of the cheſt, and ſo its tongues mix with the tongues of the ſerratus anticus major. The internal oblique muſcle again riſes lower down the thorax, from its edge, from the cartilages of the ribs. The tranſverſe muſcle ariſes within the thorax, from the internal ſurface of the ribs, oppoſite to where the tongues of the external oblique lie; and the diaphragm ariſing from the ſame ribs, mixes its indigitations with the tranſverſalis; ſo that Caſpar Bartholin, obſerving this indigitation to be very curious in the larger animals, believed the diaphragm and tranſverſe muſcles to be but one great trigaſtric or three bellied muſcle ſurrounding all the abdomen.

CXLVI. The RECTI muſcles cover the abdomen on its fore part, in a line from the pubis to the ſternum; and they belong ſo equally to the ſternum and to the pubis, that it is indifferent which we call their origin, and which their inſertion. The origin (as I ſhould call it) of each rectus muſcle is in the ſternum; is broad and fleſhy; lies upon the outſide of the ſternum, covering part of the ſternum, and all the xiphoid cartilage, and touching and mixing its fibres with the great pectoral muſcle. It is about four inches broad all down the abdomen, and terminates at the ſide of the ſymphyſis pubis with a flat and pointed tendon about an inch in length and about an inch broad. This muſcle is croſſed at intervals by four tendinous interſections, which divide it into five diſtinct bellies. Commonly there are three bellies above the umbilicus and two below; but the recti muſcles are the leaſt regular of all the muſcles of the abdomen. Veſalius, Albinus, and Sabbatier, were thought to have found the recti abdominis extending up to the throat; but it is now found that Veſalius had only repreſented the muſcles of a monkey or of a dog (which are very long) upon the thorax of a human ſubject *; Sabbatier, upon reviſing his notes, retracts what he had ſaid; and Albinus alſo is ſuppoſed to have ſeen only a production of the maſtoid muſcle, extending down the breaſt; for irregularities of this kind are very often found.

CXLVII. The PYRAMIDAL muſcles are as a ſupplement to the recti. There is a ſmall neat pyramidal muſcle on each ſide, or rather a triangular muſcle, fleſhy through its whole extent and length, with its baſe turned towards the pubis and its apex towards the umbilicus; ſo that its origin is in the creſt of the pubis, and its pointed inſertion in the linea alba: and though the pyramidal muſcles have been ſuppoſed by Maſſa to relate

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* "Porro (r) linea inſignitur, quæ carneam recti muſculi par-
" tem finit, quæque ultima ipſius inſertionis in homine eſt portio,
" uti in quarta tabula ad characterem n. eſt cernere. Intercapedine
" igitur ab r. ad s. pertinente, ſe offert recti SIMIÆ abdominis muſ-
" culi tendo, ſeu membrana, excarniſve muſculi pars; t. autem in-
" dicat carneam muſculi ſedem, primæ coſtæ et ſecundæ thoracis in-
" ſertam, eſtque latus ille tendo hominibus haudquaquam, ut in
" caudatis ſimiis, et canibus conſpicuus."

VESALIUS, p. 156.

late to the penis, or by Fallopius to belong to the urinary bladder, their true uſe is only to aſſiſt the rectus to draw down the ſternum, and tighten the linea alba, and ſo to give greater power to the oblique and tranſverſe muſcles. The pyramidalis is ſo irregular a muſcle, that ſometimes two are found on one ſide and none at all on the other. Sometimes two on each ſide, ſometimes there is but one, and very often they are awanting, the belly of the rectus coming quite down to the pubis.

1. The LINEA ALBA is the common meeting of all the thin flat tendons; and therefore we call it their inſertion, being the common point towards which they all act: it is white, by the gathering of all the colourleſs tendons.

2. The LINEA SEMILUNARIS is a line of the ſame white appearance, of a circular form, and produced by the meeting of all the tendons, on the edge of the rectus muſcle, to form a ſheath for it.

3. The SHEATH for the RECTUS MUSCLE does not admit of ſo brief a definition as theſe: It has been commonly ſuppoſed to be formed in a very curious manner, chiefly by the broad tendon of the obliquus internus, which being the central muſcle betwixt the two other layers, is ſuppoſed to have its tendon ſplit into two thin ſheets; that the outermoſt ſheet adheres to the outer oblique muſcle, forming the outer part of the ſheath, while its inner ſheet adheres to the tendon of the tranſverſe muſcle, forming the inner part of the ſheath: but this is too intricate, and can hardly be proved by diſſection. Cowper expreſſes his doubts about the doctrine of the tendon of the inner oblique muſcle being ſplit into two layers; and I

think the trueſt deſcription is this, that all the tendons meet and adhere in the ſemilunar line; that they immediately part to form this ſheath; that the flat tendons of both the oblique muſcles go upon the outer ſurface of the rectus to form that ſide of the ſheath; that the tendon of the tranſverſe muſcle only lies under the rectus, forming the lower part of the ſheath, and that it is unaſſiſted by any lamella of the inner oblique muſcle; that the ſheath is complete at the fore part, or over the muſcle; but that under the muſcle the ſheath ſtops about five or ſix inches above the pubis, and that there the recti muſcles (or in their place the pyramidal muſcles) lie bare upon the bladder and other abdominal viſcera, lined only by the thin peritonæum †. And that this back layer of the ſheath is thinner and more delicate, and but little attached to the back part of the rectus muſcle, which is eaſily raiſed in diſſection; while the fore part of the ſheath adheres firmly to the fore part of the muſcle, forming thoſe croſs bands or tendinous interſections which divide the rectus into bellies; and the ſheath where it lies over the muſcle cannot be diſſected without a degree of violence either to the ſheath or to theſe tendinous interſections.

4. The UMBILICUS is that opening in the centre of the abdomen, in the middle of the linea alba, through which the nutritious veſſels of the fœtus paſs. The

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† Cowper had never obſerved this, but once that the lower part of the rectus was not lined by the tendon of the tranſverſalis. He concluded that, in this inſtance, it was a ſporting of nature; "ſo "much a luſus naturæ, that accidents like this might be the cauſe "of certain ruptures."

veſſels have degenerated into ligaments in the adult, and the umbilicus is cloſed in the form of a ring; but ſometimes it is forced by violent action, and the viſcera come out by it, forming umbilical hernia.

5. The RING of the ABDOMINAL MUSCLES is that opening near the lower part of the abdomen, juſt over the pubis, through which the ſpermatic cord paſſes in man, and the round ligament of the womb in women.

Cowper (p. 5.) ſays, that the ſpermatic cord paſſes through ſeparate rings, in each of the three abdominal muſcles; and, like older authors, he makes nature exceedingly wiſe, in placing the rings, not oppoſite to each other, but one high, and another lower, and a third lower ſtill, ſo as to prevent the bowels falling out. But the truth is, that neither the internal oblique, nor the tranſverſe muſcles, have any ſhare at all in the ring, which belongs entirely to the external oblique muſcle, and is formed in this way. All the tendinous fibres of the external oblique are, like the muſcle itſelf, oblique, running from above downwards; and the tendinous faſciculi are in ſome places wider, a little disjoined from each other, and reſembling ſtripes croſſed by ſmall threads of tendon, as if the long fibres were in danger of parting from each other, ſo as to leave a gap, and were held together by theſe croſs threads; and it is in fact a wider and perfect ſeparation of two fibres that forms the ring, and a ſtronger interlacement of croſs fibres that ſecures it from ſpliting farther up. But the chief ſecurity of the ring is by the form of the opening; for it is not a ring, as we call it, but a mere ſplit in the tendon, which begins about an inch and a half above the pubis, is oblique, and looking towards the pubis, like the fibres which form it, and conſiſts of two legs or pillars of the ring, as they are called; for the upper ſlip, which forms the upper part of the opening, goes directly towards the creſt or higheſt point of the pubis; the lower pillar, or the ſlip which forms the lower line of the ſlit, turns in behind, gets under the upper one, and is implanted into the pubis, within and behind the upper pillar: this lower ſlip forms at once the lower pillar of the ring and the edge of the femoral ligament.

Now this croſſing of the pillars of the ring ſecures it; for the more the muſcle pulls in preſſing upon the abdominal viſcera, the tighter is the ſlit drawn; and the obliquity of the opening gives the direction to herniæ of the groin, which always point towards the pubis, ſo as to fall into the ſcrotum in men, or into the labia pudendi in women, keeping cloſe by the groin.

The ſpermatic cord, formed of the veſſels belonging to the teſticle, paſſes through this ring of the external oblique muſcle; but as the internal, oblique, and tranſverſe muſcles, form no ſhare in the ring, the cord paſſes by their lower edge, but not through it. At the place where the cord paſſes the edge of the internal oblique muſcle, it ſends a bundle of fleſhy fibres down along the cord, which go all along the cord, gradually extend towards the teſticle, expanding and growing thin upon the upper end of the teſticle, and gradually diſappearing on its body. This is

CXLVIII. The CREMASTER MUSCLE of the TESTICLE, which is a thin ſlip of fibres from the internal oblique muſcle of the abdomen; which is deſigned for ſuſpending the teſticle, and for drawing it up; is very thick and ſtrong in the lower animals, as in bulls, dogs, &c.; is eaſily found in man, but not always, being ſometimes thin and pale, and hardly to be known from the coats upon which it lies. It appears to grow more fleſhy in old age, and to be thickened in enlargements of the teſticle, the better to ſupport the weight.

6. The LIGAMENT of the THIGH * is a diſtinct ligament, and not merely the tendon of the external oblique, rounded and turned in. It ariſes from the ſpinous proceſs of the ilium, and is inſerted into the creſt of the pubis. It receives the external oblique muſcle, for the tendon is implanted into it. Part of the fleſh of the internal oblique muſcle ariſes from the outer end of the ligament. It forms an arch under which the pſoas and iliacus internus muſcles, and the great artery of the thigh, and its anterior nerve, paſs out. The great vein, and the lymphatics of the limb, return under it to get into the abdomen; the lymphatic glands of the groin lie there. The whole interſtice is ſurrounded and filled up by cellular ſubſtance and fat, but it is not firm; the playing of the muſcles, and the fat, and inguinal glands, keep it open and lax; and at that point the bowels are apt to fall down, eſpecially in women, where the ſpine of the ilium is high and the arch wide. So little are femoral herniæ or the form of this opening underſtood, that no particular cuſhion is adapted to this part; for it is ſupported by the common bandage for the hernia of the groin:

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* This ligament of the thigh is named alſo the INGUINAL LIGAMENT; the CRURAL ARCH; the LIGAMENT of PAUPART; the LIGAMENT of FALLOPIUS, &c.

And, a few year ago, hernia of the groin was not even known by anatomiſts of the higheſt name. For Cowper ſays (explaining Paupart's ligament), "It is "not impoſſible but that ruptures may ſometimes "happen in this part; and I am apt to imagine this "to be the caſe when a rupture is very large, and "not to be retained by a truſs."

It often happens, that in vomiting, in violent coughing, in ſtraining at ſtool, or in lifting heavy weights, theſe natural openings are forced, and the bowels deſcend. The UMBILICUS is very ſeldom forced by ſudden exertion, for it is a very firm ring; but often it is ſlowly dilated in pregnancy; and hernia of the navel is infinitely more frequent with women than with men. —The opening of the RING is often kept dilated by the bowels following the teſticle when it deſcends; ſo that though the accident be almoſt forgotten, the hernia often appears again in the adult: moſt frequently the ring is forced in ſtrong young men by hard and continued labour, or by ſudden ſtraining; but women are ſafer from this kind of hernia, becauſe the round ligament of the womb is ſmaller than the ſpermatic cord, and the ring in them is very cloſe. —ABDOMINAL HERNIÆ are thoſe which come, not through any natural opening, but through the interſtices of the muſcles, by the parting of the muſcular fibres on an accidental wound in the abdomen, or by the operation of the Ceſarean ſection; for a wound of the abdominal muſcles ſeldom heals ſo neatly as not to leave ſome ſmall interſtice, through which the bowels protrude. Thus any point may be forced by violence, any of the openings, or all of them, may be relaxed by weakneſs, as in dropſical or other lingering diſeaſes: for it is from this cauſe that herniæ are more frequent in childhood and in old age; by the laxity which is natural to childhood, or by the weakneſs natural to the decline of life. Often there ſeems to be a hereditary diſpoſition to herniæ in certain houſes; the form of the openings of the abdomen being wider in a whole family, juſt as the features of the face are peculiar. And I have ſeen a child with all theſe openings ſo particularly wide, that upon the ſlighteſt coughing or crying, herniæ came down at every poſſible point, at the navel, the ſcrotum, the thigh, and in the ſides of the abdomen, all at once; or, as one tumour was reduced, another aroſe.

The effects of the abdominal muſcles in moving the trunk cannot be miſtaken. The RECTI pull the ribs downwards in breathing, flattening the belly, and bending the body forwards. The two OBLIQUE MUSCLES of one ſide acting, turn the trunk upon its axis; but the oblique muſcles of the oppoſite ſide acting, cooperate with the rectus in flattening the belly and bending the body: and the TRANSVERSE MUSCLES tighten the linea alba, ſo as to give effect to all the others; and particularly they brace the ſheath of the recti muſcles, ſo as to give them their true effect.

CXLIX. The DIAPHRAGMA is a Greek word, tranſlated inter-ſeptum; the tranſverſe partition betwixt the abdomen and the thorax; the midriff: but it is not merely a tranſverſe partition, it is a vaulted diviſion betwixt the thorax and abdomen; and not only is the middle raiſed into a vaulted form, but its obliquity is ſuch, that though its fore part be as high as

the

the ſternum, its lower and back part ariſes near the pelvis from the loweſt vertebræ of the loins.

It is a circular muſcle, which is fleſhy towards its borders, and tendinous in the centre; which is convex towards the thorax, and concave towards the abdomen; becoming plain, or almoſt ſo, when it preſſes againſt the abdominal muſcles in drawing the breath; and returning to its convex form when the abdominal muſcles react in puſhing it back into the thorax.

The diaphragm ariſes, by one broad fleſhy attachment, from all the borders of the cheſt, forming the upper or greater muſcle of the diaphragm; and it ariſes below, by many ſmall tendinous feet, from the fore part of the loins, which, meeting, form what is called the leſſer muſcle of the diaphragm. 1ſt, The GREAT or UPPER muſcle ariſes, firſt, from under the xiphoid cartilage, and from the lower ſurface of the ſternum. 2dly, From all the falſe ribs; from the cartilage of the ſeventh, eighth, and ninth ribs; and from the bony parts of the tenth and eleventh ribs; and from the tip of the twelfth rib. All theſe origins are, of courſe, fleſhy digitations or tongues, which intermix with thoſe of the tranſverſe muſcle of the abdomen. 3dly, From the tip of the twelfth rib to the lumbar vertebræ there is a ligament extended, which, going like an arch over the pſoas and quadratus lumborum muſcles, is named LIGAMENTUM ARCUATUM; and from this another part ſtill of the great muſcle of the diaphragm ariſes. Thus the upper muſcle of the diaphragm has four chief origins, viz. from under the ſternum and xiphoid cartilage; from all the falſe ribs;

from the ligamentum arcuatum; and, in ſhort, from all the borders of the cheſt, from the xiphoid cartilage quite round to the vertebræ of the loins.

2. The LESSER MUSCLE of the DIAPHRAGM, which ariſes from the ſpine, begins by four ſmall ſlender tendinous feet on each ſide. The firſt of theſe, the longeſt one, ariſes from the ſecond vertebra above the pelvis: it goes from the flat fore part of its body, and adheres to the fore part of all the lumbar vertebræ as it mounts upwards. The ſecond riſes from the third vertebra, but farther out towards the ſide of the vertebra. The third ariſes from the ſide of the fourth vertebra. And the fourth tendon of the diaphragm ariſes from the tranſverſe proceſs of the ſame fourth vertebra of the loins. But indeed we ought, in place of this minute demonſtration, to ſay, that it ariſes from the four uppermoſt lumbar vertebræ by four tendinous feet, flat and gliſtening, and adhering cloſely to the ſhining ligament with which the bodies of the vertebræ are ſtrengthened; that theſe tendons ſoon join to form a ſtrong round fleſhy leg, which is called the crus diaphragmatis; of which crura the left is the ſmaller one; and that theſe crura, joining, mixing, and croſſing their fibres, form a fleſhy belly, the leſſer muſcle of the diaphragm.

3. The TENDON in the centre of the diaphragm is determined in its ſhape by the extent of theſe fleſhy bellies; for the great muſcle above almoſt ſurrounds the central tendon. The ſmaller muſcle below meeting it, the two diviſions give it a pointed form behind; the tendon has the figure of a trefoil-leaf, or of the heart painted upon playing cards. The middle

line of this tendinous centre is fixed by the membrane which divides the thorax into two; the two ſides go upwards into the two ſides of the cheſt, each with a form like the bottom of an inverted baſin; their convexity reaching within the thorax, quite up to the level of the fourth true rib: the proper centre of the diaphragm is fixed by this connection with the mediaſtinum, that its motion might not diſorder the action of the heart, which reſts upon this point, and whoſe pericardium is fixed to the tendon: but the convexity of either ſide deſcends and aſcends alternately as the diaphragm contracts or is relaxed; ſo that it is chiefly theſe convexities on either ſide which are moved in breathing.

Thus is the diaphragm compoſed of one great and circular muſcle before; of one ſmaller circular muſcle behind; and of the triangular tendon, as the centre betwixt them: and both in its fleſhy and tendinous parts, it is perforated by ſeveral veſſels paſſing reciprocally betwixt the thorax and the abdomen.

Firſt, The AORTA or great artery of the trunk paſſes betwixt the crura or legs of the diaphragm, which like an arch ſtride over it to defend it from preſſure.

Secondly, The OESOPHAGUS paſſes through the diaphragm a little above this, and to the left ſide: its paſſage is through the lower fleſh belly, and through the moſt fleſhy part of the diaphragm: and the muſcular fibres of the crura diaphragmatis firſt croſs under the hole for the œſophagus, then ſurround it, then croſs again above the hole; ſo that they form the figure of 8: and the œſophagus is ſo apparently compreſſed by theſe ſurrounding fibres, that ſome anatomiſts have reckoned this a ſort of ſphincter for the upper orifice of the ſtomach.

Thirdly, The great VENA CAVA goes up from the abdomen to the heart, through the right ſide of the diaphragm ; and this hole being of a triangular form, being in the hard tendon, and larger than the vein requires, there is no danger of ſtrangulation in the vein.

The tendon is compoſed of fibres which come from the various faſciculi of this muſcle, meet and croſs each other with a confuſed interlacement, which Albinus has been at much pains to trace, but which Haller reports much more ſenſibly: "Intricationes "variæ et vix dicendæ;" irregular and confuſed, croſſing chiefly at the openings, and eſpecially at the vena cava, the triangular form of which ſeems to be guarded in a moſt particular way.

The lower ſurface of the diaphragm is lined with the peritonæum or membrane of the abdomen; and the upper ſurface is covered with the pleura or membrane of the cheſt. The hole for the vena cava is ſo large, that the peritonæum and pleura meet, and touch each other through this opening all round the vein.

The chief uſe of the diaphragm is in breathing; and in this office it is ſo perfect, that though there be a complete anchyloſis of the ribs (as has often happened), the perſon lives and breathes, and never feels the loſs. The diaphragm is, in its natural ſtate, convex towards the thorax; when it acts, it becomes plain, the thorax is enlarged, and by the mere weight of the air the lungs are unfolded and follow the diaphragm. No vacuum is ever found betwixt the diaphragm and the lungs; but the lungs follow the ribs and diaphragm as cloſely as if they adhered to them; and indeed when they do adhere, it is not known by any diſtreſs; ſo we draw in the breath: and when the abdominal muſcles react, the diaphragm yields, goes back into the thorax, and grows convex again, by which we blow out the breath; and while the diaphragm is acting, the abdominal muſcles are relaxed, yield, and are puſhed out, and leave the ribs free to be raiſed by their levator muſcles. And again, when the abdominal muſcles react, the diaphragm in its turn yields ſo that they at once force up the diaphragm, and pull down the borders of the thorax, aſſiſting the ſerrated muſcles which depreſs the ribs.

There is alſo in every great function ſuch a wonderful combination of actions conſpiring to one end, as cannot be even enumerated here. But the alternate action and reaction of the abdominal muſcles draws in and expels the breath, promotes the circulation, and gently agitates the bowels, while their more violent actions diſcharge the fæces and urine, and aſſiſt the womb; and vomiting, yawning, coughing, laughing, crying, hiccup, and the reſt, are its ſtronger and irregular actions. The diaphragm might well be named by Haller, "Nobiliſſimus, poſt cor, muſculus." And Buffon, who affected the character of anatomiſt with but little knowledge of the human body, might miſtake its central tendon for a nervous centre, the place of all motions, and almoſt the ſeat of the ſoul. For the ancients confounded the names and ideas of tendon and nerve. And in ſickneſs and oppreſſion, lowneſs and ſighing, in weeping or laughing, in joy or in fear, all our feelings ſeem to concentrate in this part.

CHAP.

CHAP. VII.

THE MUSCLES OF THE PARTS OF GENERATION, AND OF THE ANUS AND PERINÆUM.

The muſcles of the parts of generation follow this diviſion of the abdominal muſcles more naturally than any other.

The ERECTOR PENIS is a ſmall and ſlender muſcle, which goes over the crus penis, and braces it back to the pubis. The erectores are ſuppoſed (by preſſing the penis againſt the pubis) to compreſs the great vein, and ſo cauſe erection. The ACCELERATOR URINÆ is a muſcle which ſurrounds all the bulb of the urethra, and acts by a ſort of ſubſultus in diſcharging the laſt drops of the urine, and in throwing out the ſemen. And the TRANSVERSALIS PERINÆI, which goes acroſs the perinæum, belongs rather to the anus than to the penis. The SPHINCTER ANI is a circular bundle of fibres which ſurrounds the orifice of the anus, and contracts it; and the LEVATOR ANI is a flat thin muſcle, which lines the pelvis, ſurrounds the rectum like a funnel, and being fixed round the margin of the anus, raiſes it up; and the COCCYGÆUS is but a part of it. The DETRUSOR URINÆ is the muſcular coat of the bladder; and the SPHINCTER VESICÆ is not eaſily diſtinguiſhed from the detruſor urinæ, being but the fibres of it, only thicker and ſtronger at the lower and narrower part of the bladder.

The penis is compoſed of two crura or cavernous bodies, which ariſe from the branch of each os iſchium, which ſoon meet to form the body of the penis; and of the corpus cavernoſum urethræ, which ſurrounds the urethra, is attached to no bone, but begins juſt before the circle of the anus, by a bulging which is called the bulb of the urethra; and the erector penis lies along the crura, to draw them back to the pubis; and the accelerator ſurrounds all the bulb, and acts in expelling the ſemen or the laſt drops of urine.

CL. The ERECTOR PENIS is a delicate and ſlender muſcle, about two inches in length. It lies along the face of the crus penis of each ſide. And when the crura penis are inflated, the erectors are ſeen of their proper length and form. The erector of each ſide riſes by a ſlender tendon from the tuberoſity of the os iſchium. It goes fleſhy, thin, and flat, over the crus penis, like a thin covering. It ends in a delicate and flat tendon upon the crus penis, about two inches up; and the tendon is ſo thin and delicate, that it is hardly to be diſtinguiſhed from the membrane of the cavernous body.

The erectors lying thus on the ſides of the penis, have been called COLATERALES PENIS, or ISCHIO-CAVERNOSI,

NOSI, from their origin in the iſchium, and their inſertion into the cavernous bodies.

CLI. The TRANSVERSALIS PERINÆI is often named tranſverſalis penis; but its origin being in the tuberoſity of the os iſchium, by a delicate tendon, and its inſertion into the very backmoſt point of the bulb of the urethra, where it touches the anus, its courſe is directly acroſs the perinæum; and its relation to the perinæum and anus is very direct and evident; while its relation to the penis is rather doubtful. Often there is a ſecond muſcle of the ſame origin and inſertion running like this acroſs the perinæum, named TRANSVERSALIS PERINÆI ALTER.

This tranſverſe muſcle may, by bracing up the bulb to the arch of the pubis, have ſome effect in ſtopping the vein on the back of the penis, and ſo producing erection; but its chief uſe muſt be in preventing the anus from being too much protruded in diſcharging the fæces, and in retracting it when it is already protruded.

CLII. The ACCELERATOR muſcle is not a ſingle muſcle, as it is often deſcribed: it is manifeſtly a pair of muſcles ſurrounding the whole of the bulb of the urethra. For there is along the lower face of the bulb a white and tendinous line, correſponding with the outward line or ſeam of the perinæum. This line diſtinguiſhes the bellies of the two muſcles: the fibres of each ſide ſurround their proper half of the bulb with circular fibres, winding obliquely round the bulb; and each muſcle ends in its ſeparate tendon, which is delicate and ſmall, and which, leaving the bulb of the urethra, turns off obliquely to the ſide; ſo that the tendon

of

of each ſide goes out flat and thin upon the crus penis of its own ſide, a little higher than the inſertion of the erector penis; and thus it embraces the bulb itſelf with its two crura. We know and feel its convulſive involuntary action in throwing out the ſeed; and we are conſcious that we uſe it as a voluntary muſcle in emptying the urethra of the laſt drops of urine.

CLIII. The SPHINCTER ANI muſcle is a broad circular band of fibres which ſurrounds the anus. It ariſes from the point of the os coccygis behind. It ſends a neat ſmall ſlip forwards, by which it is attached to the back part of the accelerator muſcle. It is of a regular oval form, and is two inches broad, and is for a very obvious reaſon ſtronger in man than in animals. Some chooſe to enumerate two ſphincter muſcles, of which this is the external or cutaneous; and what they deſcribe as the internal one, is merely the circular fibres, or muſcular coat of the inteſtine, ſtrengthened a little towards the anus, but not a diſtinct muſcle. Its effect is to ſhut the anus.

CLIV. The LEVATOR ANI muſcle is deſcribed as a pair of muſcles, one from each ſide: but it is properly one broad and thin muſcle, which ariſes from the internal ſurface of all the fore part of the pelvis; and from its breadth it has been named MUSCULUS ANI LATUS. It continues its origin from the internal ſurface of the pubis, all the way round to the ſacrum. It grows gradually ſmaller as it goes downwards to ſurround the anus. So it is inſerted into the circle of the anus, into the point of the os coccygis, and is mixed with the ſphincter ani muſcle. The whole pelvis is lined with it like a funnel or inverted cone; the wider part repreſenting its origin from the pelvis, the narrower part its inſertion into the anus. The whole bladder is ſurrounded and covered by this muſcle; the urethra paſſes through a ſplit in its fibres; and no operation of lithotomy can reach the bladder from below without cutting through this muſcle. It raiſes the anus, and at the ſame time dilates it; opening the anus for the paſſage of the fæces, and ſupporting it, ſo as to prevent its being protruded. Thus it is not for ſhutting the anus, as ſome have ſuppoſed, but is the direct antagoniſt of the ſphincter ani muſcle. By encloſing the bladder, the levator ani acts upon it alſo; for the neck of the bladder paſſing through a ſlit in its fibres, while the levator ani is acting, this ſlit is drawn, as it were, round the neck of the bladder, and ſo the urine is for the time prevented from flowing. It is as a ſphincter to the bladder, which prevents our paſſing the urine and fæces at the ſame moment. By ſurrounding the lower part of the bladder, and encloſing the proſtate gland, and the veſiculæ ſeminales, which lie upon the back of the bladder, this muſcle affects theſe parts alſo; and is perhaps the only muſcle which may be ſuppoſed to empty the veſiculæ, or to compreſs the gland, pulling upwards at the ſame time, ſo as to preſs the back of the penis againſt the pubis, to maintain the erection, and to aſſiſt the accelerator muſcles. By encloſing the bladder, veſiculæ, proſtate, and anus, this muſcle produces that ſympathy among the parts which is often very diſtreſſing; as in gonorrhœa, the ſtone in the bladder, conſtipation, piles, and other diſeaſes of theſe parts: for piles, conſtipation, or any cauſe which may excite the action of the levator muſcles, will cauſe erections,

rections, a deſire to paſs the urine, and an obſtruction in the diſcharge of it.

CLV. The MUSCULUS COCCYGÆUS is a thin, flat, muſcle, which ariſes by a narrow point from the inſide of the pelvis at the ſpine of the os iſchium; is implanted, expanded, and fleſhy, into the whole length of the os coccygis; can be uſeful only by pulling up the point of the os coccygis, which is juſt equivalent to raiſing the circle of the anus; ſo that from every circumſtance of its form and uſe, it might be fairly enough deſcribed as being merely the back part of the levator ani muſcle.

The perinæum, where the bulb begins, is the point into which all the muſcles are united; for the accelerator muſcle, and the ſphincter ani muſcle, touch at the beginning or point of the bulb; and a ſmall pointed ſlip of the ſphincter ani, going upon the bulb, connects them firmly together. The tranſverſalis perinæi come acroſs the perinæum from either ſide; and the levator ani muſcle comes down to meet the ſphincter; ſo that the ſphincter ani, the levator ani, the tranſverſalis perinæi, and the accelerator urinæ muſcles, all meet in one point, viz. the back of the bulb. They ſecure the perinæum, and ſupport the heavy viſcera of the abdomen: if they be unſkilfully cut in performing lithotomy, it will be difficult to extract the ſtone. In that operation the inciſion paſſes by the ſide of the anus, and on the inſide of the tuber iſchii; and our knife accordingly cuts clean acroſs the tranſverſe muſcles, which ſtand as a bar acroſs the perinæum; it paſſes by the ſide of the erector muſcle, need not touch it, or touches it ſlightly, and by a ſort of chance: It muſt not touch the accelerator muſcle; for whoever ſays he cuts the accelerator, cuts too low, and performs his operation ill. After the firſt inciſion we get deep into the pelvis, and cut the levator ani. The ſurgeon does not obſerve theſe muſcles, on account of any danger which may attend wounds of them, but takes them as marks for the true place of his inciſion; and a good operator will be careful to have them fairly cut, that they may be no hinderance to the extraction of the ſtone *.

CHAP.

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* The detruſor urinæ is but the muſcular coat of the bladder; the ſphincter viſicæ, or muſcle of the proſtates, is but a denſer faſciculus of this common coat of the bladder. I ſhould no more think of deſcribing them here than of deſcribing the coats of the inteſtines or ſtomach. Theſe muſcles of internal parts, with the muſcles of the internal ear, &c. I reſerve for thoſe books which deſcribe the organs and viſcera.

CHAP. VIII.

MUSCLES OF THE THIGH, LEG, AND FOOT.

MUSCLES MOVING THE THIGH-BONE.

THE muſcles belonging to the thigh-bone ariſe all from the pelvis or trunk. The PSOAS MAGNUS and ILIACUS INTERNUS come from within the pelvis, at its fore part, and, paſſing under the femoral ligament, go down to be implanted into the trochanter minor; and by this obliquity of their inſertion, they turn the toes outwards, and bend the thigh. Other muſcles come from the lower and fore part of the pelvis; as the PECTINALIS, TRICEPS, and OBTURATOR EXTERNUS, which ariſe from the arch of the pubis, and go down to be implanted into the linea aſpera, and leſſer trochanter; and they, pulling the thigh towards the body, are called the ADDUCTORS. Others ariſe from the ſacrum and back part of the pelvis, as the GLUTÆI, which, coming directly forwards to be implanted into the greater trochanter, pull back the thigh; and a fourth ſet coming alſo from the internal ſurface of the pelvis, viz. the OBDURATOR INTERNUS, and the PYRAMIDALIS, come out through the back openings, turn round the pelvis as round a pully, and roll the thigh, and draw it back. This completes the catalogue of thoſe muſcles which move the thigh.

1. The PSOAS MAGNUS, ILIACUS INTERNUS, PECTINEUS, TRICEPS, OBTURATOR EXTERNUS, which, coming from before, are inſerted into the leſſer trochanter, and bend the thigh.

2. The GLUTÆI, GEMINI, PYRIFORMIS, OBTURATOR INTERNUS, and QUADRATUS, which come from behind, are implanted into the great trochanter, and extend the thigh; and it hardly need be remembered, that as, when the arms being fixed, their muſcles raiſe the weight of the body, as in climbing or in turning over a bar, by graſping with the hands; ſo the muſcles of the thigh move that thigh only which is looſe and free from the weight of the body, while the muſcles of the other thigh, which is fixed by the weight of the body, move not the thigh, but the trunk upon the thigh; ſo that our walking is performed not ſo much by the muſcles of the thigh moving the limb, as by their moving the pelvis, i. e. rolling the trunk upon the limb.

MUSCLES MOVING THE THIGH.

1. THE THIGH IS MOVED BACKWARDS AND OUTWARDS

By the Glutæus maximus,	which is implanted into the	Linea aſpera,
——— medius,		Trochanter major,
——— minimus,		Top of trochanter.

2. THE THIGH IS MOVED BACKWARDS, AND ROLLED UPON ITS AXIS,

By the Pyriformis,	which is implanted into the	Root of the trochanter,
Gemini,		———
Obturator externus,		———
——— internus,		———
Quadratus,		betwixt the trochanters.

3. THE THIGH IS MOVED FORWARDS AND INWARDS

By the Pſoas magnus,	which is implanted into the	Trochanter minor,
Iliacus Internus,		————
Pectinales,		Linea aſpera,
Triceps,		————

Fascialis. I begin with this muſcle, as it is neceſſary in the diſſection. The thigh is incloſed in a very ſtrong ſheath, which, like that of the arm, ſends down among the muſcles ſtrong tendinous ſepta or partitions; and the muſcles are incloſed in theſe ſepta; and the great muſcles of the leg are ſupported by it in their ſtrong and continual actions. The tendinous faſcia of the thigh ariſes chiefly from the ſpine of the ilium, partly (over the groin) from the external oblique muſcle of the abdomen. Every faſcia has ſomething added by each muſcle, and takes a new increaſe and adheſion at each bone which it paſſes. It is always ſtrengthened by adheſions to joints, and comes down from them thicker upon the muſcles below; and ſo this faſcia of the thigh, which ariſes chiefly from the ſpine of the ilium, deſcends, covering all the muſcles of the thigh: it ſends partitions down to the linea aſpera and trochanters; it has a new adheſion and a new ſource of tendinous fibres at the knee; it adheres moſt remarkably at the inner ſide of the tibia, and then deſcends to the bran; it covers all the leg, and is again reinforced at the ankle: and this I believe to be a juſter hiſtory than the common idea of making it an expanſion of the ſmall tendon of the ſmall muſcle, which I am now to deſcribe; for the faſcialis is too eſſential to the ſtrength of the leg to depend upon ſo inconſiderable an origin, and would be found there though this muſcle were away, as in the palmaris of the hand.

This faſcia conſiſts properly of two plates; one is that which comes down from the creſt of the ilium, and from the muſcles of the belly; the other, that which ariſes purely from the tendon of the muſculus faſcialis, and which is at the ſame time connected with the capſular ligament of the femur and with the trochanter; and ſo the muſcle lies betwixt the two plates of the faſcia; and as the faſcia at this part takes at leaſt a reinforcement from the capſular ligament, and from about the trochanter major, the faſcialis muſcle may be ſaid to be inſerted into the trochanter.

So this great tendinous faſcia has theſe connections: the creſt of the ilium; the ligament of Paupart at the rim of the belly; the creſt and arch of the pubis; the tuber iſchii, and ſo back along the coccyx to the ridge and proceſſes of the ſacrum; the ligament of the joint, the great trochanter, and the linea aſpera, all the way down to the knee, where its laſt adheſion is very ſtrong, and from whence it comes off again much ſtrengthened.

It is thicker on the outer ſide and back part, and very thin on the inner ſide of the thigh; and it dives with perpendicular diviſions among the muſcles of the thigh.

CLVI. The FASCIALIS MUSCLE. The muſcle is rightly named tenſor vaginæ femoris; for hardly any other uſe can be aſſigned. It ariſes from the upper ſpinous proceſs of the ilium, i. e. from the fore part, or very point of its ſpine, by a tendon of about an inch in length. It is very ſmall at its origin and at its termination. It is thick and fleſhy in the middle, ſwelling out. It extends downwards, and obliquely backwards, almoſt to the middle of the thigh; and there it terminates obliquely, betwixt the two lamellæ of the membrane to which it belongs.

Its uſe is chiefly to make the faſcia tenſe, to prepare the muſcles for ſtrong action; and perhaps, by its adheſions about the trochanter, it may have ſome little effect in rolling the thigh, ſo as to turn the toes inwards, and oppoſe the Gemini.

CLVII. PSOAS MAGNUS.—This and the following muſcle come from within the body to move the thigh forwards. This is a very long and fleſhy muſcle; of conſiderable ſtrength; of conſtant uſe; perpetually employed in moving the thigh forwards, or in ſupporting the pelvis upon the thigh-bone, ſo as to preſerve the equilibrium of the body.

It is named from PSOA LUMBUS; is a large round muſcle, very ſtrong, of great length, filling up all the ſpace upon either ſide of the ſpine, and bounding the pelvis at its ſide. It comes from under the ligamentum arcuatum of the diaphragm; for it ariſes firſt by its uppermoſt head from the laſt vertebra of the back, then ſucceſſively from each of the vertebræ of the loins. It ſticks cloſe to the lumbar vertebræ; for it ariſes, not only from the tranſverſe proceſſes, but from the ſides of the bodies. Theſe heads do not appear; for they are covered by the body of the muſcle, which goes down thick and round till it reaches the ſacro-iliac ſymphiſis, and then, being united to the internal iliac muſcle, they deſcend through Paupart's ligament.

CLVIII. The PSOAS PARVUS does not, like this, belong to the thigh, but is a muſcle of the loins which ariſes along with this one from the laſt vertebra of the back and the firſt of the loins. It is a ſmall and delicate muſcle; ends in a ſlender tendon, which goes down by the inner ſide of the great pſoas, but does not go out of the pelvis along with it: it ſtops ſhort, and is implanted into the brim of the pelvis, into the os ilium, near the place of the acetabulum: it bends the ſpine upon the pelvis. This muſcle is more regular in the monkey: in the dog it is ſeldom awanting. It is ſaid to be more frequently found in women than in men: in both it often is not to be found; but ſometimes in ſtrong and big men three pſoas muſcles have been found.

CLIX. The ILIACUS INTERNUS is a thick, very fleſhy, and fan-like muſcle, which occupies the whole concavity of the os ilium.

Its origin is from the internal lip of the criſta ilii: it adheres to all the concave ſurface of that bone down to the brim of the pelvis; to the fore part of the bone under the ſpinous proceſs; and to a part alſo of the capſular ligament of the joint: all its radiated fibres are gathered together into a tendon at the ligament of Paupart. This tendon is longer on the lower than on the upper ſurface: for below it ſlides on the pubis as upon a pulley, and continues tendinous that it may bear the friction; but above it is unconnected, or it is connected only by looſe cellular ſubſtance; and there it is quite fleſhy. Juſt under the ligament the two tendons are joined; whence they bend obliquely round to be implanted into the leſſer trochanter.

The pſoas magnus aud iliacus internus are two very powerful muſcles. Their chief uſe is to bend the thigh, and more peculiarly of the lumbar one to ſupport the body. The great blood-veſſels come down along with theſe two muſcles: The muſcles and veſſels are both ſurrounded with looſe cellular ſubſtance. Matter often forming behind the abdomen, round the pſoas muſcle, is named the pſoas abſceſs; and penetrating under Paupart's ligament, burſts in the thigh at laſt, and is commonly fatal.

CLX. The PECTINEUS, or PECTINALIS, is ſo named from its ariſing at the pecten or pubis; is a broad flat ſquare muſcle; lies along ſide of the laſt deſcribed muſcles; and is inſerted with their common tendon. It ariſes flat and fleſhy from that line of the pubis which forms the brim of the pelvis, and is implanted into the linea aſpera by a tendon flat and long, pretty nearly of the ſame extent and ſhape with its origin.

This muſcle lies immediately under the ſkin and faſcia lata; and by its bending round under the thigh-bone it has three actions: to cloſe the knees together; to pull the thigh forward; to perform rotation, turning out the toe; and in certain poſitions of the limb it will pull the thigh back, aſſiſting the extenſor muſcles.

CLXI. The TRICEPS FEMORIS is a broad flat muſcle, with three heads, ariſing from the pubis, and inſerted into the whole length of the linea aſpera down to the condyle, and ſerving for preſſing the knees together or bringing the thigh forwards.

The triceps conſiſts of three heads, which lie in different layers, one above the other; and have ſo little connection among themſelves, that they have been more commonly, and I think properly, deſcribed as three muſcles. Theſe three parts of the muſcle are indeed for one common uſe: but they are of very different forms; for they do not even lie on the ſame plane: one is long; another ſhorter by one half; a third longer than both the other two; ſo that they have been commonly deſcribed under the names of ADDUCTOR PRIMUS or LONGUS; ADDUCTOR SECUNDUS or BREVIS; ADDUCTOR TERTIUS or MAGNUS.

1. The ADDUCTOR LONGUS is the uppermoſt layer; its border (for it, like the pectinalis, is a flat muſcle) ranges with the border of the pectinalis. It ariſes from the upper and fore part of the pubis by a ſhort roundiſh tendon, very ſtrong: it ſwells into a thick fleſhy belly, not round, but flattened; the belly grows flatter as it goes down towards the thigh-bone; it ends in a flat and ſhort tendon, which is inſerted web-like into the linea aſpera in all its middle part, viz. about four inches. Thus the muſcle is of a triangular form, with its baſe in the linea aſpera, and its apex on the pubis. Its head or origin lies betwixt the pectinalis and the gracilis: its upper edge ranges with the pectinalis; its lower edge lies upon the triceps magnus. It is called longus, becauſe it is longer than the next head.

2. The ADDUCTOR BREVIS lies under the adductor longus, and is of another layer of muſcles; for as the firſt layer conſiſts of the pectinalis, triceps longus, and gracilis, this layer conſiſts of the obturator externus,

triceps brevis, and triceps longus. The triceps brevis is exceedingly like the former, in riſing near the ſymphiſis pubis, by a thick and flattened tendon, ſwelling like it into a ſtrong fleſhy belly; like it, it grows flat, and is inſerted by a ſhort flat tendon into the inner trochanter and linea aſpera. But it differs in theſe points: that it is leſs oblique; for this muſcle being ſhorter, goes more directly acroſs betwixt the pelvis and the thigh: that it is placed higher than the laſt; ſo that whereas the adductor longus is inſerted into the middle of the thigh-bone, this one is inſerted into the leſſer trochanter, and only the upper part of the linea aſpera; and the triceps longus is a ſuperficial muſcle, while this is hidden under it and behind it. The longus takes its riſe from the very creſt of the pubis; this takes its origin from the fore part of the pubis, from the limb juſt under the creſt, ſo as to be immediately under the head of the longus.

3. The ADDUCTOR MAGNUS, the third head of the triceps, is a very long and flat muſcle, lying behind the other heads. It ariſes by a ſhort tendon, juſt under the tendon of the adductor brevis: it continues to have a fleſhy origin all down the ramus and the tuber iſchii (i. e.), from the flat edge of the thyroid hole. From this broad origin it goes to be implanted into the thigh-bone the whole length of the linea aſpera, its fibres having various degrees of obliquity according to their inſertion; for the uppermoſt faſciculi go almoſt directly acroſs, to be inſerted flat into the upper part of the linea aſpera; the ſucceeding faſciculi go more and more obliquely as they deſcend, the lower part of the muſcle following that rough line

which leads to the condyle; and the laſt fibres of all are implanted by a tendon of conſiderable length into the condyle itſelf. This adductor magnus makes, as it were, a flat partition betwixt the fore and the back parts of the thigh; and it is about three inches above the condyle that the great artery paſſes betwixt this tendon and the bone, perforating the triceps, to get from the fore to the back part of the thigh, and down into the ham.

The uſe of all theſe muſcles is entirely the ſame, making allowance for their various degrees of oblique inſertion; and they muſt be very powerful, by the great diſtance of their origins from the centre of that bone which they move: ſo that while other muſcles pull in a direction very oblique, theſe three heads of the triceps muſt pull almoſt at right angles, the moſt favourable direction of all.

CLXII. The OBTURATOR EXTERNUS is named after the obturator ligament, from which it ariſes. The ligament and the muſcles ſhutting up the foramen thyroideum are named OBTURATORS; and it is ſometimes named ROTATOR FEMORIS EXTRORSUM, from its turning the thigh outwards. It ariſes from the ramus of the iſchium and pubis where they form the margins of the thyroid hole; and from the outer ſurface of the ligament, which it occupies entirely, leaving only room for the obturator veſſels and nerves. It is a ſhort muſcle; its origin is broad, and its inſertion narrow, ſo that it is of a conical form; for the fleſh of this muſcle is gathered very ſoon into a round ſhort tendon, which twiſts under the thigh-bone betwixt it and the pelvis; ſo that it is in a manner rolled round the thigh-bone, being

ing inſerted into the root of the great trochanter. It pulls the thigh forwards, but is more peculiarly a rotator of the thigh. This muſcle is of the ſecond layer; and the ſucceſſion of all the muſcles is this: the upper layer conſiſts of the pſoas and iliacus, where they come out from the abdomen; of the pectinalis; and of the long head of the triceps: the ſecond layer conſiſts of the ſhort head of the triceps: and the third layer conſiſts of the obturator externus at the upper part, and of the triceps magnus, or third head of the triceps, all down to the condyle.

GLUTÆI.—There are three glutæi muſcles, each under the other, and each ſmaller than the muſcle which covers it. The FIRST, ariſing from the back part of the ilium, the back of the ſacrum, and the ſacro-ſciatic ligament, forms the whole hip, and deſcends ſo low as to be inſerted into one-third of the length of the linea aſpera, and into the root of the great trochanter.

The SECOND ariſes from all that portion of the ilium which is before this one, and from the back of the bone, and goes down to be inſerted into the very top of the great trochanter.

The THIRD ariſes from the back of the bone below the laſt, down to the acetabulum and ſacro-ſciatic ſinus; and it is inſerted into the root betwixt the apex of the great trochanter and the neck of the bone.

CLXIII. The GLUTÆUS MAXIMUS ariſes from the back of the ilium one half its length; from the joining of the ilium and ſacrum; from all the ſpines and irregularities of the ſacrum; and from the ſacro-ſciatic ligament. Its thick fleſhy faſciculæ come in a winding

ing and oblique direction down to the thigh-bone; and, being gathered into a flat and pretty broad tendon, it is inſerted into the root of the trochanter major, and down three inches of the linea aſpera. This is one of the largeſt and moſt fleſhy muſcles of the body; covers all the other muſcles of the hip; forms the contour of the hip; pulls the thigh backwards, or the body forwards upon the thigh when the thigh is fixed: and being a wide ſpreading muſcle, which in a manner ſurrounds its joint, its different portions act with different effects; not only according to their natural direction, but according to the accidental poſitions of the pelvis with regard to the thigh-bone.

CLXIV. The GLUTÆUS MEDIUS or MINOR is ſmaller than the former, but like it. It ariſes from all the outſide of the ilium not occupied by the glutæus major. It, like the other, is a fan-formed muſcle; for its fibres converge from its broad origin in all the back of the ilium, to form a ſhort flat tendon, which is inſerted into the back or into the very top of the great trochanter. It lies in part under the glutæus maximus; but its chief part lies before the glutæus maximus: and as certain portions of the muſcle are before the thigh-bone, there are poſitions of the pelvis and thigh bone in which it will pull the thigh forewards, although its proper office is to aſſiſt the glutæus magnus in pulling the thigh backwards, and moving it outwards from the body.

CLXV. The GLUTÆUS MINIMUS is a ſmall radiated muſcle, which lies deep and quite under the former. It has, compared with the former, a very narrow origin; for it ariſes chiefly from the loweſt part of the back of

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the ilium, viz. that part which forms the ſocket for the thigh-bone, and a little higher up; and from the border of the ſciatic notch. It forms a ſhort, flat, and ſtrong tendon, which is fixed under the root of the trochanter major, betwixt the trochanter and the neck of the bone: ſo that theſe muſcles are inſerted in this ſucceſſion; firſt, the great glutæus, below the root of the trochanter, and into the linea aſpera; the middle glutæus into the back and top of the trochanter; and the ſmalleſt of the glutæi is implanted into the roughneſs under the root of the trochanter.

Gemini.—The gemini are two muſcles, or rather one biceps muſcle; but the heads are ſo diſtinct that they are reckoned two, and ſo much alike that they are named gemini.

CLXVI. The uppermoſt, the larger and ſtronger muſcle, ariſes from the ſpinous proceſs of the os iſchium.

CLXVII. The ſecond, or ſmaller head, ariſes in like manner from the tuber iſchii, upon its ball or outer end. They are fleſhy in their whole length. They meet and unite their tendons at the great trochanter. They are inſerted firmly, along with the following tendon, at the root of that proceſs.

CLXVIII. The pyriformis, ſometimes called iliacus internus or pyramidalis, comes from the hollow of the ſacrum, runs in the ſame line with the leſſer glutæus, and is inſerted with the two laſt named muſcles in the root of the great trochanter.

Its origin is from the hollow of the ſacrum, riſing from the vertebræ of that bone by three or four ſmall fleſhy digits, and from the ſacro-ſciatic notch; it runs betwixt the glutæus minor and the gemini, and its round tendon is inſerted betwixt them, ſomewhat connected with each.

The pyriformis, gemini, obturator internus, and quadratus, form what ſome anatomiſts have called MUSCULI QUADRIGEMINI ; and they are ſo much alike in inſertion and uſe, that it would be waſte of time to repeat what has been ſaid of the gemini and obturator.

This muſcle, the pyriformis, like the others, rolls the thigh outwards. It name is from its ſhape.

CLXIX. The OBTURATOR INTERNUS, once named MARSUPIALIS or BURSALIS, ariſes from all the internal ſurface of the obturator ligament, and from all the edges of the thyroid hole, from the ilium, iſchium, and pubis: So it ariſes within the pelvis; comes out by turning round the iſchium in the notch betwixt its tuber and its ſpine. Its origin is therefore circular and fleſhy. It runs along the inſide of the os iſchium, turns round that bone betwixt the ſpinous proceſs and the tuber. The hollow there is guarded with cartilage; and this tendon runs in the hollow, like a pulley round a rope; paſſing this, it runs betwixt the two legs of the gemini, and its tendon is united to theirs; and the three, appearing almoſt like one tendon, are inſerted together into the root of the trochanter major. Theſe, then, might with ſome propriety be named one muſcle: all the three, viz. the two gemini muſcles and the obturator muſcle, paſſing between them, were once accounted as one muſcle, and then it ſeemed to be a muſcle with two bellies and an intermediate tendon; and this intermediate tendon, with two fleſhy ends, give it the appearance of a purſe, and thence it was named MUSCULUS MARSUPIALIS, or BURSALIS.

CLXX. The QUADRATUS FEMORIS, is a thin flat muſcle, paſſing in a tranſverſe direction betwixt the tuber iſchii and the thigh-bone.

It ariſes from the lower and flattened ſurface of the TUBER ISCHII by a ſhort tendinous beginning. It goes a little obliquely upwards and outwards, and is inſerted into the back of the great trochanter, in that roughneſs which is found juſt where the trochanter is joined to the bone, and goes obliquely betwixt the trochanter major and the trochanter minor.

It rolls the thigh-bone, ſo as to turn the toe outwards, and pulls it almoſt directly backwards.

The MOTIONS of the THIGH muſt be performed by many very ſtrong muſcles, as it moves under the weight of the whole body; and it ſeems to be curiouſly contrived, that the muſcles fit for moving the thigh forward ſhould, in certain poſitions of the thigh, move it backwards; alſo giving an increaſe of ſtrength to that motion of the thigh in which moſt ſtrength is required.

There are but two, or chiefly two, points for inſertion; the trochanter major and the trochanter minor. Theſe two points are ſo oblique, that no one muſcle, nor ſet of muſcles, performs any direct motions; for they all twiſt round the bone's axis, to get at their inſertion. The glutæi, the pyriformis, the gemini, the quadratus, the obturator internus and obturator externus, all bend round the axis of the thigh-bone, to reach the TROCHANTER MAJOR. Theſe now may be called the abductors of the thigh, to pull it outwards; but we ſhould conclude from this direction, that they could not pull the thigh backwards, for the thigh-bone would turn on its axis and elude their action. The pſoas magnus, the iliacus internus, the pectinalis, and the triceps, do in the ſame manner go round the inner ſide of the bone: the two firſt to be implanted into the trochanter minor, the two latter into the linea aſpera, juſt below it. Theſe are juſtly named adductors of the thigh: their chief uſe is to draw the thighs together: And this is the combined effect of theſe two ſets of muſcles. When the adductors act by themſelves, they pull the thigh forwards, moving the leg, rolling the thigh-bone, and turning the toe out in a graceful ſtep; which is moſt peculiarly the effect of the pectinalis and triceps. But when we are to finiſh the motion, by pulling forward the body, which is the ſame with pulling back the thigh, it is not merely the antagoniſts of theſe muſcles, as the glutæi, the gemini, &c. which muſt act. Were the glutæi to act alone, they would rather turn the thigh upon its axis outwards than pull it back; but the triceps, &c. act again in conjunction with the glutæi, &c. and by the action of the triceps, the inner trochanter is fixed; the further rolling of the thigh is prevented; the full effect is given to the glutæi muſcles. When the glutæi act, they pull the thigh directly backwards, aſſiſted by the triceps, pectinalis, and others: for now the thigh-bone is ſo far advanced before the body, that thoſe muſcles, as the triceps, which were benders of the thigh in its firſt poſition, are extenſors when it is advanced a ſtep before the body; or, perhaps, it will be more explicit to ſay, that when the thigh is moved one ſtep before the body, the iliacus internus, pſoas magnus, and triceps muſcles, co-operate, agree with the glutæi muſcles in bringing the trunk forwards to follow the limb, and then in fixing and ſtiffening the trunk upon that limb, till the other thigh is advanced a ſecond ſtep before the body.

The MUSCLES of the LEG are the moſt ſimple of all: for the knee is a mere hinge, at leaſt it is ſo in all our ordinary motions; ſo that there is no action to be performed but thoſe of mere flexion and extenſion; and there are only two claſſes of muſcles to be deſcribed, the extenſors and the flexors of the leg.

1. The EXTENSORS of the LEG. The only muſcles which extend the leg are thoſe four, which may be very fairly reckoned a quadriceps extenſor cruris. Indeed the French anatomiſts arrange them ſo. Sabbatier calls them the triceps femoris. Theſe muſcles, which all converge to the patella, and are inſerted in it, are:

Rectus Femoris,	Vaſtus Externus,
Cruræus vel Femoræus,	Vaſtus Internus.

And theſe are all implanted by one tendon; becauſe the joint being a hinge, bending only in one direction, its muſcles could have given but one motion, however oblique their origin and courſe had been.

2. The FLEXORS of the LEG are one on the outſide and four on the inſide of the leg; the tendons of the outſide being implanted into the upper knob of the fibula, and thoſe in the inſide into the rough head of the tibia, forming the hamſtrings, and extending their tendons or aponeurotic expanſions downwards upon the leg.

INSIDE FLEXORS.

Sartorius,	Gracilis,
Semitendinoſus,	Semimembranoſus.

OUTSIDE FLEXOR.

Biceps.

FLEXOR lying in the HAM.

Muſculus Poplitæus.

EXTENSORS OF THE LEG.

CLXXI. The RECTUS FEMORIS, ſometimes RECTUS CRURIS, is ſo named from its direction; it is a thin flat muſcle, and ariſes by two heads. The firſt or greater head ariſes from the lower ſpinous proceſs of the ilium by a ſhort round tendon; its ſecond head is in a different and ſomewhat of a curved direction; for it comes from the edge of the acetabulum and from the capſular ligament. Theſe join together, and form a flat tendon of four inches in length, which becomes gradually fleſhy and larger down to its middle, and then again contracts towards the patella in the ſame gradual manner. There is a middle tendinous line running the whole length of the muſcle, eſpecially conſpicuous on its back part; and towards that central line all the muſcular fibres converge.

The rectus is united at the ſides to the vaſti; at the back part to the cruræus; and its tendon, along with that of the cruræus, goes to be directly implanted into the rotula of the knee.

The rectus cruris is the firſt of thoſe muſcles which Sabbatier calls the TRICEPS FEMORIS; and ſurely they may be as properly named thus as the TRICEPS CUBITI EXTENSOR.

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This large maſs of muſcle or fleſh enwraps the whole of the thigh-bone behind as well as before: for, firſt, the CRURÆUS ariſes fleſhy from all the fore part of the bone; the VASTUS EXTERNUS from the great trochanter, and all the back part and outer ſide of the bone; and the VASTUS INTERNUS ariſes, in like manner, from the leſſer trochanter, and all the inner ſide of the bone, from the trochanter major all round to the origin of the cruræus.

CLXXII. The CRURÆUS ariſes from the fore part of the TROCHANTER MINOR; and it continues its origin from the fore part of the femur, the whole way down to within two inches or little more of the patella. About three inches from its origin it is joined by the VASTUS EXTERNUS, which unites with it at the outer edge and fore part; and the VASTUS INTERNUS comes into it about five inches below its origin, and joins it at the inner edge and fore part. At its lower part it is joined to the tendon of the rectus, to form but one large tendon, which is inſerted into the rotula.

Under the cruræus are ſometimes found two little muſcles, or rather two little ſlips of this muſcle, which are quite diſtinct. They ariſe on the fore part of the thigh-bone, two or three inches above the capſule of the joint; and they are inſerted into the capſule on each ſide of the patella, evidently for the purpoſe of pulling it up, to prevent its being catched; and when theſe two (SUBCRURÆI) are not found as diſtinct muſcles, ſome fibres of the cruræus ſupply their place.

CLXXIII. The VASTUS EXTERNUS is the largeſt of theſe three muſcles, Its origin is by a pretty thick and ſtrong tendon from the lower and fore part of the trochanter major; and it continues its origin from the root of the trochanter all down the linea aſpera to that rough line which goes to the inner tuberoſity of the thigh-bone.

It touches the end of the cruræus about four inches below its origin, and continues attached to it the whole way down; and then it forms a flat tendon which connects itſelf with the tendon of the RECTUS FEMORIS, and then embraces in a ſemicircular manner the outſide of the patella. And ſeveral of the fibres of this aponeuroſis not only croſs over the rotula, but go down over its oppoſite ſide to glide along the head of the tibia, and to be inſerted into the inner ſide of the knee.

CLXXIV. The VASTUS INTERNUS is neither ſo large nor ſo fleſhy as the VASTUS EXTERNUS; but it is exceedingly like it in all other reſpects.

It ariſes from the fore part of the trochanter minor, juſt under the inſertion of the pſoas magnus; and it continues its origin from the linea aſpera the whole way down to the inner condyle, exactly oppoſite to the origin of the vaſtus externus, ſo that their origins meet; they leave juſt a channel betwixt them. The vaſtus internus, very ſoon after its origin, joins itſelf to the cruræus, or middle portion, and accompanies it in all its length: and at the diſtance of two inches from the rotula it unites itſelf with the tendon of the cruræus at its internal edge; and this tendon completes that junction which unites the four muſcles into a quadriceps cruris. This vaſtus internus deſcends much lower, in a fleſhy form, than the external vaſtus does; and forms that fleſhy cuſhion which covers the inner ſide of the knee joint. Its tendon embraces the rotula ſomewhat in the ſame circular form with that of the vaſtus externus; and, like the externus, it ſends ſome fibres acroſs the knee-pan, to be inſerted in the outer part of the head of the tibia.

The RECTUS, and the VASTUS EXTERNUS, INTERNUS, and CRURÆUS, form one large maſs of fleſh, which embraces and incloſes all the thigh-bone; and they are ſo connected, that the cruræus cannot be ſeparated, and cannot be neatly diſtinguiſhed.

The uſe of theſe four muſcles is evident to extend the leg and to bend the thigh on the trunk, or reciprocally to bend the trunk on the thigh. This, or theſe two motions alternately, is the common uſe of theſe muſcles, as in walking; and they are moſt peculiarly uſeful in running and leaping.

After deſcribing a large maſs, conjoined in one tendon, and concurring in one ſimple action, it is ſuperfluous to ſay that its power muſt be great. This power muſt be ſtill further increaſed by the rotula, which removes the force from the centre, and gives the advantage of a pulley, which it really and truly is: without this pulley theſe muſcles could be of no uſe in certain ſituations; for inſtance, in the recumbent poſture: for then the extending muſcles being in the ſame line with their bones, could have no farther power; but the rectus, by the pulley of the rotula, and by its attachment to the baſin, raiſes the trunk, or at leaſt helps the pſoas, the iliacus, and the muſcles of the belly.

The rotula is again attached to the tibia by a ſtrong ligament, to ſuſtain the pulling of theſe great muſcles *.

FLEXORS OF THE LEG.

CLXXV. The SARTORIUS or TAYLOR'S MUSCLE, is ſo named from its bending the knees and drawing the legs acroſs. It is the longeſt muſcle, and a very beautiful one: it extends obliquely acroſs the whole length of the thigh, croſſing it like a fillet or garter, about two inches in breadth.

It ariſes from the upper ſpinous proceſs of the os ilium, by a tendon about half an inch in length; its thin flat belly extends obliquely acroſs the thigh, like a ſtrap, and is inſerted in the ſame oblique form into the inner tubercle of the head of the tibia; its aponeuroſis ſpreads pretty widely, going over the whole joint of the knee a thin ſheet of tendon.

From the oblique poſition of the muſcle, it might in action change its place; but it is cloſely embraced by the faſcia lata, and is tied by ſuch adheſions as form ſomething like a peculiar ſheath of itſelf.

It

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* Theſe muſcles are in continual action: for their office is to reſiſt the bending of the knee, which would happen by this incumbent weight of the body; ſo that the continual ſupport of the body depends wholly on theſe muſcles; and they are the great agents in running, leaping, walking, &c. Since, by extending the knee, they raiſe the weight of the pelvis and trunk, and of all the body, they muſt be very powerful; and accordingly when they are weighed againſt their antagoniſt muſcle, we find them greatly to exceed; for the QUADRICEPS, i. e. the rectus, cruræus, and vaſti, will weigh four pounds, while the BICEPS, &c. their antagoniſts, weigh but two pounds. This experiment was often repeated by the great Cowper for Mr Brown, who was delivering lectures on muſcular motion.

It turns the thigh like the quadrigemini and obturator muſcles. It alſo bends the leg upon the knee; and when the leg does not yield, it bends the thigh upon the pubis; or where the thigh alſo is fixed, it bends the body forwards: but in performing that action, whence it has its name, it does all theſe; for firſt the leg and thigh are rolled, then the thigh is bended towards the belly, then the legs are bent to draw them acroſs. Though a ſmall muſcle, yet it is of great power from its origin, and in ſome degree from its inſertion alſo; being much removed from the centre of motion.

CLXXVI. The GRACILIS, ſometimes called RECTUS INTERNUS FEMORIS*, is a ſmall, flat, thin muſcle, in its general ſhape ſomewhat like the ſartorius.

It ariſes by a flat tendon of two inches in length from the pubis and near the ſymphyſis; and it paſſes immediately under the integuments down to the knee: it paſſes by the inner condyle of the knee, in the form of a ſhort round tendon; and as it bends behind the head of the tibia, it is bound down by a bundle of tendinous fibres, which croſſing it, go to the back part of the leg. After paſſing the head of the tibia, it turns obliquely forwards and downwards; it here runs behind the tendon of the ſartorius, and before that of the ſemitendinoſus. It is inſerted with the ſartorius into the ſide of the tuberoſity at the top of the tibia.

This muſcle runs alſo in a line ſo wide from the centre of motion, that its power is very great. It ſerves chiefly as a flexor of the leg: When the leg is fixed, it muſt, by its origin from the pubis, be a flexor of the thigh, and an adductor in nearly the ſame direction with the pectineus and triceps; and it is worth obſerving, that while the knee is ſtraight, the ſartorius and the gracilis cannot bend the knee; they, on the contrary, keep it ſteady and firm: but when the knee is bent, they come into action; for in proportion as the muſcles which have made the flexion are contracted, they are leſs able to contract farther; and therefore it is deſirable that more muſcles ſhould come into play.

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* GRACILIS is from its ſmallneſs; RECTUS INTERNUS is from its ſtraight direction.

CLXXVII. The SEMITENDINOSUS is ſo named from its lower half being compoſed of a ſmall round tendon; and as tendon was once miſnamed nerve, this is the SEMINERVOSUS of Winſlow, Douglas, and others.

Its origin is from the tuberoſity of the iſchium (along with the ſemimembranoſus, and touching the biceps) by a ſhort thick tendon. It alſo ariſes by many oblique faſciculi of fibres from the poſterior portion of its oppoſite muſcle the biceps cruris. This croſs connection betwixt the two muſcles continues for three inches down from the tuber iſchii; it then departs from the biceps, goes obliquely inwards, and is flattened and contracted into a tendon ſix inches from the knee. Its tendon then becoming ſmaller and rounder, paſſes down behind the inner tubercle of the knee; and getting round the head of the tibia, it comes forward to be inſerted into the tuber at the head of that bone. At this place the tendon grows broad and flat; it is expanded, and as it were graſps the inner ſide of the knee; its upper edge is joined to the lower edge of the tendon of the gracilis, ſo that the ſartorius, gracilis, and ſemitendinoſus, are implanted like one muſcle; and this tendinous expanſion ſeems like a capſule for encloſing the heads of the tibia and femur, and for ſtrengthening the knee-joint. The ſemitendinoſus bends the leg.

CLXXVIII. The SEMIMEMBRANOSUS has its name from the muſcle, which is flat, thick, and fleſhy, beginning and ending with a flattened tendon, ſomewhat like a membrane, but infinitely thicker and maſſier than ſuch a name ſhould imply.

It ariſes from the tuber iſchii, before the ſemitendinoſus and biceps. It ariſes a broad, thin, and flat tendon, of about three inches in length. It becomes fleſhy and thick in its middle, but it ſoon becomes thinner again, and terminates in a ſhort tendon, which, gliding behind the head of the tibia, is inſerted there*.

This muſcle has little connection with any other. It lies under, or, more properly ſpeaking, on the inſide of the ſemitendinoſus, and the two together form the hamſtrings. The hamſtring muſcles contribute alſo to another motion. Though, when extended, the tibia cannot roll, yet when we ſit with our knees bent, it can roll ſlightly; and ſuch rolling is accompliſhed by theſe muſcles. All theſe muſcles which bend the leg, and which conſequently extend the thigh at the ſame time, are muſcles of very great power; becauſe

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* The two tendons of this muſcle, the membranous tendon at the head, and this ſmaller one by which it is inſerted, ſtand ſo obliquely, that the muſcular fibres betwixt them muſt be very oblique; for the membranous tendon deſcends low upon the back part or edge, and the tendon of inſertion begins high upon the fore edge of the muſcle.

cauſe they ariſe in one common point, the tuber iſchii, and that point is very far diſtant from the centre of motion.

There is ſtill one ſmall muſcle, a flexor of the leg, which performs this rotation during the bent ſtate of the knee with moſt particular power.

CLXXIX. The MUSCULUS POPLITÆUS, which is ſo named from its lying in the ham, is a ſmall triangular muſcle, lying acroſs the back part of the knee-joint, very deep under the hamſtrings, and under the muſcles of the leg.

Its origin is from the outer condyle of the thigh-bone, and from the back part of the capſule of the joint. Its tendon is ſhort and thick, but of no great extent. It paſſes fleſhy behind the knee-joint; and it is inſerted broad into a ridge on the back part of the tibia; ſo that by its ſmall origin and broad inſertion it is a fan-like muſcle; its fibres being almoſt tranſverſe, and its lower fibres nearly perpendicular. Beſides bending the leg, it is uſeful by pulling aſide the capſule to prevent its being catched.

CLXXX. The BICEPS CRURIS, ſo named from having two heads, a long and ſhort one, lies immediately under the ſkin, in the back part of the leg, running down from the pelvis to the knee, to form the outer hamſtring.

It is the ſingle flexor on the outſide of the thigh. Its origin is from the outer part of the tuber iſchii by a tendon of an inch and a half in length. And this tendon is, in its origin, cloſely united with that of the ſemitendinoſus for two inches, or at leaſt the whole length of the tendon. After a ſhort, but very thick fleſhy belly, it degenerates into a tendon, eſpecially on its back part; and this tendon, which begins above the middle of the thigh, is continued the whole way down.

About one-third down the bone is the beginning of the ſecond or ſhort head, which has its origin all the way down the linea aſpera to the line above the outer condyle of the thigh-bone; and here it is ſomewhat connected with the origin of the vaſtus externus muſcle and the inſertion of the glutæus magnus. The tendons of the two heads are joined a little above the inner condyle, and go outwards to be inſerted into the outer part of the head of the fibula, forming the outer hamſtring.

Its inſertion ſurrounds the head of the fibula, and a ſmall portion alſo ſinks betwixt the bump of the fibula and the inner head of the tibia, to be implanted into it alſo.

This muſcle, like the oppoſite ones, ſerves for bending the leg. The ſhort head ſimply bends the leg; the long head aſſiſts the ſhort one in bending the leg, and is alſo a muſcle of the thigh.

The muſcles of the foot are ſix EXTENSORS and one FLEXOR MUSCLE.

EXTENSORS.

GASTROCNEMIUS vel GEMELLUS,
GASTROCNEMIUS INTERNUS vel SOLEUS,
TIBIALIS POSTICUS,
PERONEUS LONGUS,
———— BREVIS,
PLANTARIS,

} all lying on the back part of the leg.

The FLEXOR is,

The TIBIALIS ANTICUS,	lying on the fore part of the leg.

CLXXXI. The GASTROCNEMIUS is often divided into three muſcles, named GASTROCNEMII or GEMELLI. But, far from counting thus, we ſhould rather favour the arrangement of Douglas, who couples this with the next muſcle, as forming a quadriceps or two muſcles joined with two heads each, and he calls it the EXTENSOR CRURALIS.

The GASTROCNEMIUS is the great muſcle of the brawn: its two heads are two very large and fleſhy bellies, which ariſe from the tubercles of the thigh-bone. The inner head is the larger, and ariſes by a ſtrong tendon from the back of the inner condyle, and a little way up the rough line; and it has alſo a ſtrong adheſion to the capſular ligament of the knee.

The outer head is ſhorter than this: It ariſes, in the ſame way, from the outer tubercle of the thigh-bone; and the two muſcles meet and run down together, forming the appearance of a rapha, by the direction of their fibres. But the two bellies continue diſtinct till they meet in the middle of the leg. They are diſtinct at their back part, but at their fore part they are connected by a tendinous aponeuroſis, or ſtrong but flat tendon; and the two bellies being about the middle of the leg united firmly, they form a large flat tendon, very broad at its beginning, which unites with that of the ſoleus a little above the ankle.

CLXXXII. SOLEUS.—This name is from its reſemblance to the ſole-fiſh; and it is often named

GASTROCNEMIUS INTERNUS. This, like the laſt muſcle, has two HEADS, which ariſe from either bone.

One head ariſes from the bulb of the fibula, and continues to adhere to one fourth of the upper part of the bone; another head ariſes from about three inches of the upper part of the tibia. The firſt of theſe heads is large and round; the ſecond is ſmaller and round: they unite immediately; and a large fleſhy belly is formed, with ſtill a conſpicuous diviſion betwixt the fleſh of the two heads. The great tendon begins about half way down the leg, but ſtill is intermixed with fleſhy fibres till it approach the heel. A little below the middle of the leg this tendon is united with the tendon of the gaſtrocnemius, to form the great back tendon, named tendo Achillis, and ſometimes, though very rarely, chorda magna.

The tendon is large; it grows ſmaller as it approaches the heel; when it touches the extremity of the heel bone, it expands to take a firmer hold.

In running, walking, leaping, &c. this muſcle, with the extenſors of the leg, are the great muſcles. The external gaſtrocnemius has double power; for it, ariſing from the tubercles of the thigh-bone, is both an extenſor of the foot and a flexor of the leg; but the gaſtrocnemius internus is a mere extenſor of the foot, and both together have ſuch ſtrength as often to break the tendo Achillis.

CLXXXIII. PLANTARIS.—This muſcle is named from a miſtaken notion of its going to the planta pedis or ſole of the foot, to form the plantar aponeuroſis, like the palmaris of the hand; but, in fact, it does not go to the ſole, but is a mere extenſor of the foot, inſerted along with the tendo Achillis.

This long and ſlender muſcle is ſituated under the gaſtrocnemius internus. It ariſes from the external condyle of the femur wholly fleſhy; it alſo has an attachment to the capſular ligament of the joint; after an oblique fleſhy belly of about three inches, it forms its ſmall flat tendon. The tendon runs betwixt the inner head of the gaſtrocnemius and the ſoleus; and where the tendo Achillis begins, the tendon of the plantaris attaches itſelf to the inner edge and fore part of the Achillis tendon; it accompanies it down to the heel, running in a groove which ſeems made to receive it; and it is implanted with the tendo Achillis into the inner ſide of the heel-bone. It is often awanting.

The uſe of this muſcle is to tuck up the capſule in the great bendings of the knee-joint, and to aſſiſt the gaſtrocnemii muſcles.

The PERONÆI muſcles are thoſe which ariſe from the fibula. They are named from their length being different: the PERONÆUS LONGUS being as long again as the BREVIS; for it is one-half longer in its origin, the one riſing at the head, the other at the middle of the bone; and again it is one half longer at its inſertion, going fully round under the foot to the oppoſite ſide, while the ſhorter peronæus ſtops at the ſide of the foot to be inſerted.

CLXXXIV. The PERONÆUS LONOUS is ſo named from its lying along the fibula. It ariſes partly tendinous, chiefly fleſhy, from the upper knob of the fibula, and from the ridge of the bone, down to within three inches of the ankle. It has another ſmall ſlip of a head from the upper part of the tibia, above where the fibula joins; it has alſo adheſions to the tendinous partition, which ſeparates this from the EXTENSOR DIGITORUM COMMUNIS and the SOLEUS.

Its tendon begins very high, above the middle of the leg; and it continues to receive the fleſhy fibres almoſt at right angles in the penniform manner. The tendon is concealed down to about or below the middle of the leg: then it is ſeen immediately under the integuments; and we can eaſily diſtinguiſh it through the ſkin, being that acute line or ſtring which runs down behind the inner ankle, and which gives ſhape to that part.

In paſſing the outer ankle, it runs down through a cartilaginous pulley or annular ligament, which alſo tranſmits the peronæus brevis: it leaves the peronæus brevis on the ſide of the foot; and paſſing by itſelf in a groove of the heel-bone, it bends obliquely acroſs the arch of the foot, goes quite down to the oppoſite ſide, and is inſerted into the metatarſal bone of the great toe, and the great cuneiform bone on which it is founded. Under the eminence of the OS CUBOIDES it ſuffers great friction, ſo as to be thickened to a degree of oſſification, and to reſemble a ſeſamoid bone. It is alſo thickened in a leſſer degree as it paſſes the outer ankle; and in all this length it is tied down by a ſtrong ligamentous expanſion.

It is a powerful extenſor of the leg; it alſo gives that obliquity of the foot, which is ſo handſome and natural, and uſeful in walking. This muſcle particularly turns down to the ground the inner edge of the foot; ſo it preſſes to the ground the ball of the great toe; and that is the part which touches the ground, and which feels ſore after long walking or violent leaping or running: It is by that part that we puſh in making a ſtep; ſo that this muſcle is perceived to be continually active in all motions of walking, leaping, running, and more particularly in dancing.

CLXXXV. The PERONÆUS BREVIS is like its fellow except in length and inſertion. Its origin is from the ridge of the fibula; beginning about one-third down the bone, and continuing its adheſion the whole way to the ankle. It alſo has adheſions to the tendinous partition which is betwixt it and the common extenſor; ſo that theſe two muſcles are by ſuch adheſions very difficult to diſſect. It is ſmaller at its origin, but increaſes in its fleſhy belly as it deſcends; and it is fleſhy lower down than the peronæus longus. It is like it, a penniform muſcle. The tendons of the two peronæi paſs together by the outer ankle in the ſame ring: but the tendons croſs each other; for the peronæus longus is in its belly more forward. The brevis lies under, and behind it, quite covered by it; and yet the tendon of the brevis, by creeping under the longus, gets before it, juſt under the outer ankle; and from that it runs in a ſeparate groove, ſuperficially, upon the outer edge of the foot, to be inſerted into the metatarſal bone of the little toe. In both muſcles the tendon is upon the outer edge, and begins almoſt as high as the upper head of each muſcle. This tendon of the peronæus brevis is the ſhorter one, is ſmall where it paſſes through the pulley, and expands when it reaches its inſertion, that it may graſp the metatarſal bone firmly. The tendon of the longer muſcle alſo expands a little, and ſomewhat in the form of a hand and fingers, taking hold of two bones by three little heads.

This muſcle aſſiſts the former in extending the foot, and coincides well in its oblique action with the laſt; for as the laſt turned down the inner edge of the foot, this turns the outer edge upwards, which is exactly the ſame motion.

CLXXXVI. The TIBIALIS POSTICUS is a penniform muſcle, very much like the two laſt deſcribed, only its tendon goes round the cartilaginous pulley of the inner ankle.

It is named TIBIALIS from its origin, and POSTICUS from its place.

It ariſes from the back part and ridge of the tibia, from the oppoſite part of the fibula, and from the interoſſeous membrane below theſe; and it continues its attachment to the interoſſeous ligament quite down to the ankle. It has alſo ſtrong attachments to the ſurrounding tendinous partitions. Its fibres are all oblique, and go to the middle tendon, which is in the heart of the muſcle. About the middle of the tibia this tendon begins to emerge from the fleſhy belly; it grows gradually ſmaller, but ſtill continues to receive fleſh quite down to the ankle. It paſſes in the groove of the inner ankle, and is retained there by ſuch a ligament as holds the peronæi. After paſſing the ligament, it expands in the hand-like form, to graſp the bones of the tarſus: and it is expanded much more than the peronæus; for it ſends roots down among the bones both of the tarſus and metatarſus, ſo as to take hold firſt on the lower rough part of the naviculare in paſſing over it. Then it is implanted into the two firſt metatarſal bones, then into the calcaneum, and laſtly into the os cuboides; and where it paſſes over the os naviculare it is hardened into a ſort of ſeſamoid bone. In ſhort, it is implanted in the ſole of the foot by a tendon like a hand, which ſends down its fingers among the tarſal and metatarſal bones, to take the ſureſt hold. This muſcle pulls the foot in ſo as put the toes together; and when balanced by the peronæi, it directly bends the foot.

CLXXXVII. The TIBIALIS ANTICUS croſſes obliquely the fore part of the leg. It ariſes from the fore part and outſide of the tibia. It begins juſt under the outer tuber, and continues its adheſion down two-thirds of the bone; then the tendon begins to be formed: and this muſcle, like almoſt all the ſmaller ones of the leg, adheres to the tendinous partitions, and to the faſcia, with which they are covered. The tendon begins almoſt with the origin of the muſcle; but continues covered by the fleſh, and not appearing till within four inches or ſo of the ankle, when it begins to paſs obliquely over the leg; and having completed the croſſing above the ankle, it goes under the annular ligament in a peculiar ring; it runs along the ſide of the foot, and is implanted into the os cuneiforme internum; and a ſmall production of the tendon goes forward to be inſerted into the metatarſal bone of the great toe.

It is the only muſcle which bends the foot, that is, which turns the great toe towards the leg.

MUSCLES OF THE TOES.

THE long muſcles of the toes are juſt four, two FLEXOR and wo EXTENSOR MUSCLES. The flexor muſcles lie upon the tibialis poſticus, or behind betwixt it and the ſolæus. The extenſor muſcles again lie under the tibialis anticus, or at leaſt their heads are under it, and their bellies only appear from under it about the middle of the leg.

The flexor tendons follow the tendon of the tibialis poſticus by the pulley of the inner ankle into the hollow of the foot. The tendons of the extenſor muſcles keep with that of the tibialis anticus, and croſs over the fore part or riſing of the ankle, where the tibia is united with the aſtragalus. And in diſſection we muſt follow theſe in an oppoſite order to that in which they are deſcribed; for next to the fore part of the ſolæus is, 1ſt, The FLEXOR POLLICIS; 2dly, The FLEXOR DIGITORUM; and, 3dly, The TIBIALIS ANTICUS.

CLXXXVIII. The FLEXOR LONGUS POLLICIS is ſmall and pointed at its origin, and ariſes fleſhy from three-fourths of the fibula to within an inch of the outer ankle. It grows thicker and larger as it deſcends, and adheres to the tendinous partitions of the tibialis poſticus and of the peronæi. Its tendon can be ſeen only about an inch above the joint of the ankle. It paſſes down behind the inner ankle, where it is bound in a ſort of annular ligament. It there paſſes under the heel-bone, in the arch of the foot, betwixt the bones and the abductor pollicis; it then glides into the channel made by the two heads of the flexor pollicis brevis; it then paſſes betwixt the two ſeſamoid bones at the root of the great toe; it then goes forward in a ſheath, to be inſerted into the laſt bone of the great toe; at which implantation it is enlarged.

Its office is to bend the great toe; but it is alſo continually uſeful at every ſtep in extending the foot, or in keeping the toe firm to the ground, while the gaſtrocnemii raiſe the heel; and therefore we ſhould not be raſh in cutting away the great toe, for in it conſiſts not the ſtrength of the foot only but of the leg.

CLXXXIX. The FLEXOR LONGUS DIGITORUM PEDIS, is named, in addition, the PERFORANS; becauſe, like the perforans of the hand, it runs its tendons through the ſplit tendon of a ſmaller muſcle, which is lodged in the ſole of the foot. It is named alſo FLEXOR COMMUNIS, although there be leſs reaſon here, where there are no flexors for the individual toes, than in the hand, where there are ſeparate flexors for the individual fingers.

It ariſes from the back part of the tibia, its whole length; that is, from the end of the poplitæal muſcle, and from the ſeptum tendinoſum, by which it is divided from the tibialis anticus, which lies immediately before it; and it continues this origin from the tibia down to within three inches or ſo of the ankle. Its origin is not eaſily ſeparated before from the tibialis poſticus, nor behind from the flexor pollicis.

The tendon is not formed till very near the ankle (within two inches of it), and the fleſh ſtill accompanies it quite down to the joint. It croſſes the tendon of the tibialis poſticus behind the ankle-joint, and goes forward in the groove of the os calcis, tied down by a ſort of capſule or annular ligament. In the arch of the foot it croſſes the tendon of the flexor pollicis, from which it receives a ſlip of tendon; and thus the office of either is aſſiſted by the other, and could be wholly ſupplied by it; it then paſſes over to the middle of the ſole, and growing flatter and thicker, divides into four flat tendons. Theſe go forward, diverging till they arrive at the ends of their metatarſal bones; then they emerge from the aponeuroſis plantaris, along with the common ſhort flexor. Now both theſe tendons run under a ligamentous ſheath, and are included in it under the firſt and ſecond bones of the toes; and having perforated the ſhort flexor oppoſite to the ſecond joint, they are finally inſerted into the root of the third or laſt bone of each toe. Theſe tendons, like the correſponding ones of the foot, ſeem to be ſlit with a ſort of longitudinal fiſſure.

The proper uſe of this muſcle is to bend all the joints of the toes, but more peculiarly the laſt bone; and alſo to extend the foot, keeping the point of the toes to the ground, conſequently aſſiſting the gaſtrocnemii, and all the muſcles uſed in walking, &c.

CXC. The MASSA CARNEA JACOBI SYLVII, or PLANTÆ PEDIS, is a ſmall body of fleſh, naturally connected with the flexor longus. The maſſa carnea ariſes from the lower part of the heel-bone, in two diviſions; one (the external one) tendinous, the other fleſhy. It is, upon the whole, pretty nearly of a ſquare form; it joins the tendon of the flexor longus before its diviſion into tendons for each toe; and by the long lever that this has upon the heel-bone it muſt be of great aſſiſtance to the flexor. It is more generally conſidered in this light of a ſupplementary muſcle; by ſome it is conſidered as a diſtinct muſcle, and as the origin and firſt beginning of the lumbricales pedis.

Thus Cowper conſiders the maſſa carnea and the lumbricales as one and the ſame: that the maſſa carnea joins the tendon, covers it with its fleſh, continues fleſhy along the common tendon, till at the bifurcation it alſo parts, along with the four tendons, into four ſmall fleſhy muſcles, which are called lumbricales.

Albinus, again, paints the maſſa carnea diſtinctly terminating at the common tendon, and the lumbricales as ariſing diſtinct from each of the divided tendons.

CXCI. The FLEXOR BREVIS DIGITORUM is alſo named the flexor ſublimis or perforatus. It ariſes from the lower part of the heel-bone, or the bump upon which we ſtand. It ariſes by very ſhort tendinous fibres; and being placed immediately under the plantar aponeuroſis, it takes hold of it, and alſo of the tendinous partitions betwixt it and the two abductors of the ſmall and of the great toe, which are on either ſide of it. Under the metatarſal bones it divides itſelf into four heads; their tendons begin earlier upon the ſide next the foot; they grow round; emerge from betwixt the dentations of the plantar aponeuroſis; they then paſs into the vagina or ſheath of each toe; and on this, the firſt phalanx, they lie over the tendons of the long extenſors. About the root of this firſt bone they divide into two little bands, which form a ſplit (like the perforatus of the fingers) for the paſſage of the long tendon.

The long tendon paſſes through it upon the ſecond joint of the toe; and immediately after the perforated tendon fixes itſelf by the two forks to each ſide of the ſecond bone or phalanx of the toe.

Its uſe is to bend the firſt and ſecond joints of the toes, but moſt peculiarly the ſecond. And the obliquity of the long flexor is exactly balanced by a correſponding obliquity of the ſhort flexor: for the tendon of the long flexor coming round the inner circle, runs obliquely outwards to reach the toes; while the ſhort flexor coming from the heel, which is towards the outer edge of the foot, runs in a like degree obliquely inwards, and meets the other at an acute angle near the toes.

CXCII. The LUMBRICALES muſt be diſſected after the ſhort flexor. They need no deſcription, ſince they exactly correſpond with thoſe of the hand. They riſe like them in the forks of the extenſor tendons. They, like them, paſs through the digitations of the aponeuroſis. They paſs on to the firſt bone of the toes, and, like the lumbricales of the hand, creep over the convexity of the bone, to be united along with the tendons of the extenſors. Their inſertion is always at the ſide of the toe next the great toe; and their uſe is to bend the firſt joint of the toes, and to draw them towards the great one, making an arch in the foot, and aſſiſting the tranſverſalis pedis. The EXTENSOR BREVIS lies moſt ſuperficially upon the ſole of the foot, having its origin from the inner ſurface of the aponeuroſis. The MASSA CARNEA lies deeper, having no origin but from the tip of the heel-bone, and being ſoon implanted into the tendon of the long flexor. The LUMBRICALES again riſe from the tendons of the long flexor, beginning juſt where the maſſa carnea ends in it; and the LUMBRICALES are the flexores primi internodii; the SHORT MUSCLE, the flexor ſecundi internodii; the LONG FLEXOR, the flexor tertii internodii digitorum.

EXTENSORS OF THE TOES.

CXCIII. The EXTENSOR LONGUS DIGITORUM PEDIS is very difficult to diſſect from its numerous adheſions.

It ariſes properly from the head of the tibia, at its outer and fore part, juſt under the knee; but it has alſo ſtrong adheſions to the inner ſurface of the faſcia; to the tendinous partitions betwixt it and the tibialis anticus before, and betwixt it and the peronæi behind; and alſo to the interoſſeous ligament and to the edge of the fibula. Its ſmall origin ſoon becomes thick, and is divided even from the beginning very perceptibly into three diſtinct portions. Theſe ſoon form three round tendons, which go obliquely inwards, paſs under the annular ligament of the ankle, and run in a ring of it peculiar to them and the peronæus tertius. They then traverſe the two bands of the annular ligament, upon the fore part of the foot; and now they change their direction a little, and go from within outwards, and diverge towards their proper toes. There are three portions of muſcles and four toes to be moved: the firſt portion divides its tendon into two at the joint; ſo that the firſt portion ſerves both the firſt and ſecond toe, the ſecond the third toe, and the third ſerves the fourth toe. Here the tendon of the long extenſor receives four other tendons; firſt, of the interoſſæi externi; ſecondly, of the interoſſæi interni; thirdly, of the long flexor; fourthly, of the lumbricales; and theſe form a very large ſheath, quite ſurrounding the toe.

Theſe do not only, like other extenſors, extend the toes, but alſo, by the divergence of the tendon, expand them or ſeparate them one from another.

CXCIV. The PERONÆUS TERTIUS ſhould have been deſcribed as a flexor of the foot, along with the tibialis anticus; but is ſo naturally connected with this, that it will be more eaſily underſtood now. It is often named PERONÆUS TERTIUS, ſometimes NONUS VERSALII, or ninth muſcle of the foot.

Its origin is from the fibula, chiefly from the middle downwards; alſo from the interoſſeous membrane; and ſtill from the tendinous partition which divides it from the peronæus brevis. Its origin is almoſt entirely fleſhy; and it lies behind and under the extenſor communis, ſo that it ſeems in its belly to be a part of that muſcle. Its tendon alſo paſſes along with the tendon of the extenſor communis, through the ſame ring of the annular ligament; and there going obliquely towards the outſide or edge of the foot over the ſhorter extenſor, it expands and covers the metatarſal bone of the little toe with an expanſion, and adheres to it as a flexor of the foot; and this, as well as the tibialis and other peronæi, have an oblique inſertion generally into the ſide of the foot; or if into the ſole, it is after running over the ſide, as over a pulley; ſo that all of them tend to preſs down one edge, that of the ball of the great toe, to the ground.

CXCV. The EXTENSOR DIGITORUM BREVIS is ſo connected with the extenſor longus, that it is natural to deſcribe them together. The extenſor brevis is a ſmall maſs of fleſh, ſomewhat reſembling the maſſa carnea and lumbricales of the foot. It is placed juſt where the buckle lies, upon the riſing of the foot, having its origin from the heel-bone, and running obliquely inwards.

Its origin is from the outer ſide and fore part of the heel-bone, and alſo from part of the annular ligament. It is ſmaller where it ariſes by a ſhort tendon from the heel-bone, but it gradually increaſes in ſize: it divides early into four heads, which are muſcular, and very diſtinct; the two inner of which are larger, the two outer more ſlender: each head has already formed an oblique tendon under its fleſh, which begins to appear naked about half way down the metatarſal bones. Theſe tendons croſs thoſe of the long extenſor, and paſs under them nearly about the end of the metatarſal bones. Then one is implanted into the firſt bone of the great toe, on the inſide of the long tendon under which it had turned. The ſecond, third, and fourth tendon are inſerted into their reſpective next toes, and the little toe is left without one. The three laſt of theſe tendons form a ſort of ſlit; the two ſides of which paſs along the ſides of the toes, ſurrounding the long tendon, ſomething like a perforatus; ſo that the three laſt tendons are inſerted along with the long tendons into the laſt bone of the toes.

The obliquity of this ſhort muſcle counteracts the obliquity of the long; and it ſerves to extend and to ſpread the toes, and to pull them away from the great toe.

CXCVI. The EXTENSOR POLLICIS PROPRIUS is a very ſlender muſcle, running from the top of the leg to the ſecond joint of the great toe. It ariſes from the fibula a little below its head; grows tendinous as it approaches the foot; then paſſing under the annular ligament and the croſs ligament of the foot, it goes onwards to the ſecond joint of the toe over the firſt.

The ſucceſſion in which theſe muſcles lie under and behind each other is this: Firſt, The tibialis anticus, the outermoſt muſcle, ariſes from the fore part of the tibia, neareſt the fore part of the leg, at the ridge of the tibia: Secondly, The extenſor pollicis lies immediately behind and under the tibialis anticus: Thirdly, The extenſor digitorum communis lies behind that: And, fourthly, The peroneus tertius lies behind the common extenſor like a part of that muſcle.

Theſe extenſor tendons are bound down by croſs bands, reſembling the annular ligaments of the wriſt. The general faſcia of the thigh is continued over the knee and down the leg: it is much ſtrengthened at the knee, where it adheres to each point of bone; it deſcends very thick and ſtrong over the leg, binding down and ſtrengthening the tibialis anticus and extenſor muſcles. The ſheath grows thinner towards the ankle; but where it paſſes over the joint, it is ſo remarkably ſtrengthened by its adheſions to the outer and inner ankles, that it ſeems to form two diſtinct croſs bands, which, going from the point of the outer ankle acroſs the extenſor tendons to the point of the inner ankle, forms a ſtrong crucial ligament, reſembling the annular ligament of the wriſt; ſo that this which is called the CRUCIAL LIGAMENT of the ankle or foot, is plainly but a ſtrengthening of the common ſheath.

The muſcles of the foot are the INTEROSSEI, which, in the foot, are found ſingle on the lower ſurface or ſole, but double and two-headed upon the upper part of the foot. The ABDUCTOR FLEXOR, and ADDUCTOR POLLICIS, which ſurround the great toe, ſomething like thoſe of the thumb; and the ABDUCTOR and FLEXOR MINIMI DIGITI, ſurrounding the little toe; and there is a ſmall ſlip of muſcle, the TRANSVERSALIS PEDIS, which goes acroſs the ſole of the foot.

CXCVII. The ABDUCTOR POLLICIS ariſes by very ſhort tendinous fibres from the knob of the os calcis, and alſo from a ligament which ſtretches from this knob to the ſheath which belongs to the tibialis poſticus; and it ariſes alſo from the tendinous partition betwixt it and the ſhort flexor of the toes; and although it forms a beginning tendon oppoſite to the cuneiform bone, the tendon is not naked till it has reached the middle of the long metatarſal bone. It unites with the ſhort flexor of the ſame toe, and is inſerted into the firſt bone or phalanx of the toe at its root. Its uſe is to pull aſide the toe, and at the ſame time to bend it a little; it alſo curves the foot itſelf; for a joint, or any loaded part, is much better ſupported by muſcles than by ligaments; and this arch requires ſupport more than almoſt any other part.

CXCVIII. FLEXOR BREVIS POLLICIS. This muſcle is much ſhorter than the laſt, and lies betwixt the ABDUCTOR and the ADDUCTOR: it lies immediately upon the metatarſal bone.

Its origin is by a pretty long tendon from the heel-bone, and from the OS CUNEIFORME EXTERNUM, by two ſeparate ſlips, from the heel-bone being a full inch in length; it alſo adheres to the membranous partitions on either ſide of it. It is ſoon divided into two heads; one goes to the abductor, and the other goes to the adductor, to have the tendons inſerted with theirs into the root of the firſt bone or phalanx. Theſe tendons contain the ſeſamoid bones; and the parting of the two heads makes a channel for the tendon of the long flexor to run in.

Its uſe is to bend the firſt joint of the great toe.

CXCIX. The ADDUCTOR POLLICIS is the third and laſt portion of the muſcle which encircles the great toe.

It ariſes from the heel bone by a tendon as long almoſt as that which it gives the abductor: It does not immediately ariſe from the heel-bone; but there is a ligament extended from the heel-bone to the os cuboides, and it ariſes from that ligament: This is the ligament under which the tendon of the peroneus longus glides. The adductor is divided into two fleſhy faſciculi or heads; theſe unite, and, going obliquely inwards, are inſerted either into the ſeſamoid bone, or directly into the firſt bone of the great toe.

CC. The TRANSVERSALIS PEDIS extends tranſverſely acroſs the ſole of the foot at the head of the metatarſal bones; it is a very ſmall muſcle, and reſembles a good deal the palmaris brevis.

It ariſes from the ligament which connects the bones of the tarſus together; and a ſmall muſcular belly is formed, which is inſerted into the tendon of the ADDUCTOR POLLICIS.

Its uſe is ſaid to be to make a ſort of gutter in the foot, by drawing the heads of the metatarſal bones together.

gether. But is it not evident that this is one of many inſtances of muſcles being a more perfect ſupport than ligaments?—It is a ſupport, having a ſort of intelligence, contracting or relaxing according to the neceſſity or degree of force: indeed, except this uſe, it is not eaſy to aſſign any; for there is very little occaſion for hollowing the foot in this direction.

CCI. The ABDUCTOR MINIMI DIGITI, like the abductor pollicis, is a pretty long muſcle, but very ſlender, lying on the outer ſide of the foot.

Its origin is from the knob of the heel-bone, and from the tendinous ſeptum, which covers the flexor brevis: It forms two ſmall tendons in the ſame direction; one ſmall and ſhorter tendon is fixed into the metatarſal bone, at its root; the other goes forward, to be inſerted into the root of the firſt bone of the toe: ſo that this muſcle clearly performs both the offices aſcribed to the other flexors. It bends the toe to which it belongs, and it extends and ſupports the tarſus in walking; and it carries the toe a little outwards, from which it has its name.

CCII. The FLEXOR BREVIS MINIMI DIGITI is next, and is almoſt the ſame muſcle in place and office: It is an exceedingly ſmall muſcle; it juſt meaſures the length of the metatarſal bone, and ariſes from it. Its origin is from the root of the metatarſal bone of the little toe, and from the ligament by which that bone is connected with the os cuboides; its ſmall belly runs the length of that bone; and it is implanted by a ſhort tendon into the root of the firſt bone of the little toe.

Its uſe is to bend the toe.

CCIII. The INTEROSSEI INTERNI are three ſmall muſcles ſeated in the planta pedis, as the interoſſei manus are in the palm of the hand. Their ſlender tendons paſs through the openings of the aponeuroſis plantaris; and, going on the inſide of the toes, are, like the lumbricales, inſerted along with the extenſor tendons.

Theſe pull the toes towards the great toe, bend the firſt joint, and extend the ſecond and third.

CCIV. The INTEROSSEI EXTERNI are, like the correſponding muſcles of the hand, four in number, and double headed, and have been named bicipites. They riſe from the metatarſal bones on each ſide of them: each has ſome little variety in its origin or courſe; but it is far from being worth our while to deſcribe each individually, as many do: it is ſufficient to obſerve their origin, and that their tendons all meet the tendons of the long and ſhort extenſors of the LUMBRICALES, and of the INTEROSSEI INTERNI, upon the backs of the toes; ſo that the whole forms a web, aponeuroſis, or ſheath, which covers the upper part of the toe, and adheres to its point.

The office of theſe muſcles is to extend the toes.

PLANTAR APONEUROSIS.—The palm and the ſole are much expoſed, and are ſpecially defended by a thick tendinous aponeuroſis. In the palm there is the more reaſon to ſuſpect expanſion to proceed from the tendon of the muſcle, becauſe the tendon of the palmaris is inſerted into it: yet that is not probable; for the tendon is very ſlender, and quite unfit for the generation of ſo broad a ſheet of aponeuroſis. In the foot ſuch an origin is ſtill leſs probable; for the plantaris tendon does not terminate in the plantar aponeuroſis, but is inſerted into the heel-bone.

The plantar aponeuroſis ariſes moſt diſtinctly from that part of the tuber of the heel-bone upon which we ſtand: it is divided into three ſheaths. Sabbatier makes a middle, external, and internal portion of the ſame aponeuroſis. Albinus alſo deſcribes it as three diſtinct aponeuroſes; one for the middle of the foot; one for the abductor of the great toe; and one the aponeuroſis of the abductor of the little toe; all connected together only by their edges. Cowper conſiders it as a general expanſion from the plantaris; and it is from this prejudice that the muſcle has its name.

But its true origin is from that part of the knob of the heel-bone on which we ſtand. The middle, and more pointed tendon, ariſes from the very point of the knob; the inner faſcia ariſes from the inſide of this; and the outer one from the outſide. And though thus divided into three heads, yet the whole origin is from the heel-bone, and is ſmall and pointed. From this point the aponeuroſis goes forward, expanding till it is as broad as the roots of the toes; ſo that the whole has the ſhape of a ſandal; and as it expands, its fibres are more ſcattered, ſo as to have a radiated appearance. Accordingly, the part neareſt the heel is thicker, while the broader part is thinner.

It goes forward, like the ſole of a ſhoe, till, having approached the heads of the metatarſal bones, it is divided into five heads, correſponding with the five knobs: and each of theſe heads again ſubdivides itſelf into two bands; which, paſſing on each ſide of the heads of the metatarſal bones, is fixed into the ſides, ſo as to leave room for the paſſing of the tendons, and nerves, and arteries.

Now, this middle aponeuroſis ſends down a deep ſtrong partition on each ſide of it; which is the beſt reaſon that I know for making theſe three diſtinct aponeuroſes: for, by theſe perpendicular partitions, the hollow of the foot is ſeparated into three diſtinct chambers: under the middle one are concealed the tendons of the long flexors, with the lumbricales and ſhort flexor muſcles; under the outer one, the flexor and abductor of the little finger; and under the inner one, the adductor, flexor, and abductors of the great toe.

The uſes of this great and very ſtrong aponeuroſis are: That it protects all the parts, the blood-veſſels, muſcles, and nerves that lie under it: That it ſupports the arch of the foot, both in ſtanding and in motion, paſſing from heel to toe, like a bow-ſtring, acroſs its arch: That it binds down the muſcles, and conſequently ſupports and aſſiſts them in their ſtrong actions: That it gives origin, or part of their origin, to many of the muſcles; which, by their frequent and irregular adheſion to it, are very difficult to diſſect: That it forms openings or rings, in which the tendons of the other muſcles paſs.

CHAP. IX.

OF THE MUSCULAR POWER.

That contractile power which reſides in the muſcular or living fibre, is a phenomenon the moſt wonderful and perplexing of all. When we cannot reach the true point, the mind too often condeſcends to the moſt trifling purſuits: And ſo, when the older phyſiologiſts could not underſtand the intrinſic nature of this muſcular power, they endeavoured to diſcover the ſize, the colour, and other external properties of the fibre; fooliſhly deſiring to know what, if known, could be of no avail. Colour was believed to be eſſential to the conſtitution of a muſcle: but in fowls, in amphibious animals, in fiſhes, in worms, and inſects, through all the gradations of animals, of different ſpecies or different ſizes, the colours of the muſcular fibre change. In fiſhes and in inſects it is entirely white; even in the human body it is not eſſentially red; the fibres of the iris, the muſcular coats of the arteries, the muſcles of the ſtomach, of the inteſtines, and of the urinary bladder, are colourleſs: the blood which makes this fibre red in the other parts may be waſhed away.

Then why ſhould we define a muſcle by that accidental property which it ſo often wants, and of which it may be ſo eaſily deprived; while we may define it more truly by its contractile power, the only evidence of its nature, and its chief diſtinction in the ſyſtem? for the contraction of the iris conſtitutes its nature; it is a muſcle by truer marks than by its colour: and, by the ſame rule, the muſcles of the leaſt inſect are as perfect as the muſcles of a man.

Philoſophers of the laſt age had been at infinite pains to find the ultimate fibre of muſcles, thinking to diſcover its properties in its form; but they ſaw juſt in proportion to the glaſſes which they uſed, or to their practice and ſkill in that art, which is now almoſt forſaken. Some found the fibres to be of one equal ſize in all creatures, however various: Others found them proportioned to the ſize, or age, or ſtrength, of their ſubject: but even ſuch diſcrepancies are trivial to thoſe which, in one of the greateſt of theſe minute philoſophers, are found almoſt in the ſame page; ſometimes affirming the ultimate fibre to be greater or ſmaller, according to the ſtrength of the ſubject, and again making them of equal ſize in the whale and in the inſect.

Others, leſs troubled about the ultimate ſize of theſe fibres, had conceived notions of their form, which, in the credulity of the times, roſe into the importance of doctrines; and, from the firſt raw conceptions of their authors, were finally proved by the microſcope forſooth; and while one author was drawing his rhomboidal fibres all conjoined in regular ſucceſſion, and another deſcribing them alſo from the microſcope as conſiſting of ſix cylindrical fibres involved in a ſpiral one, a third reckoned the fibres a ſucceſſion of ſpherical bodies; and Cowper thought that he was injecting with quickſilver chains of bells jointed with each other. For the honour of the age, theſe vanities are forgotten now. And why, indeed, ſhould we ſeek the ultimate fibres of the muſcle, or ſtudy their forms, when the diſcovery could not advance us one ſingle ſtep in the knowledge of its nature or eſſence? What avails it, that we have diſcovered (if we have really diſcovered) the ſhape of the particles of the blood; the wave-like fibres within the ſubſtance of the nerves; or the jointed appearance in the ſmaller fibres of muſcles? We do not underſtand the nature of the blood, the properties of the nerves, nor the contractile power of the muſcles, at all better by the knowledge of this peculiar form of the internal ſtructure, than we do by the groſſer marks of their external form.

Phyſiologiſts have, by a late ſenſe of their own weakneſs, been at laſt humbled to this becoming, but unwilling acknowledgment, that this contractility of the muſcles is an original endowment of this living matter derived from the Creator; imparted in a way which we cannot know; and ſo attached to the organization of the muſcular fibre, that when its organization is deſtroyed, this power is loſt. We have reſigned the ſearch after a mechanical or phyſical cauſe, and ſeek only to learn the properties of this living power, and the excitements by which it is moved. To this end it is neceſſary to define this power, diſtinguiſhing it from thoſe feelings or motions which reſult from the nerves. The vis inſita being that power which belongs to muſcles, is the ſource of motion and animal life. The vis nervea, being that property which is peculiar to nerves, is the ſeat of feeling, and the cauſe of voluntary motion, relating chiefly to the enjoyments and conſciouſneſs of life; for life and motion exiſt even in plants, and in many creatures which, not having nerves, have neither conſciouſneſs nor enjoyment, and in which the place of feeling is ſupplied by a leſs perfect inſtinct by this vis inſita, or ſome analogous inherent power.

This irritable power reſiding in muſcles may be defined the property by which muſcles feel and react, upon certain ſtimuli being applied, without that feeling being conveyed to the ſenſorium; without a conſciouſneſs of action; without any other natural dependence on the ſyſtem than that while certain orders of muſcles are obedient to their own ſtimuli only, as the heart to the blood, other orders of the muſcles are ready to receive the commands of the will. And above all, ſo little dependent is this action upon the nerves, that it is as perfect in animals which have no nerves; and is for a time very perfect in the parts which have been ſevered from the ſyſtems to which they belonged. This power, inherent in the muſcular fibre, belonging to its conſtitution, and not derived from without, is the vis inſita or irritability of Haller*, the vis vitalis of Goerter, the oſcillation of Boerhaave, and the tonic power of Stahl. It is ſeen in the ſpontaneous and tremulous contractions of muſcles when lacerated, as in wounds; when cut in operations; when entirely ſeparated from the body, as in experiments upon animals; like that tremulous motion which we often feel in various parts of the body, without any evident cauſe, and independent of the will. Even when the body is dead to all appearance, and the nervous power gone, this contractile power remains; ſo that if a body be placed in certain attitudes before it be cold, its muſcles will contract, and it will be fixed in that poſture till the organization yields and begins to be diſſolved. It is by this inherent power that a cut muſcle contracts and leaves a gap; that a cut artery ſhrinks and retires into the fleſh; that the whole body ſhrinks and grows ſtiff after death. Theſe are but faint indications of that latent power which can be eaſily excited to the moſt violent motions, and on which all the ſtrength of the muſcles depends: For the ligaments, tendons, burſæ of joints, and all thoſe parts which have no living power, are capable of bearing the ſame weight when dead as when alive. But ſuch is the connection betwixt the organization of a muſcle and its contractile power, that the moment it dies all its power is gone; and the muſcle which could lift a hundred pounds while alive, cannot bear the weight of a few pounds when dead. This latent power may be brought into full action by various ſtimuli. The latent power itſelf is called vis inſita; the acting power put into action, or the proof of the vis inſita, upon applying ſtimuli, is called the irritability of muſcles. This irritability is ſo far independent of nerves, and ſo little connected with feeling, which is the province of the nerves, that upon ſtimulating any muſcle by touching it with a cauſtic, or irritating with a ſharp point, or driving the electric ſpark through it, or exciting with the metallic conductors, as of ſilver and zinc*, the muſcle inſtantly contracts; although the nerve of that muſcle be tied; although the nerve be cut ſo as to ſeparate the muſcle entirely from all connection with the ſyſtem; although the muſcle itſelf be ſeparated from the body; although the creature upon which the experiment is performed may have loſt all ſenſe of feeling, and have been long apparently dead. Thus a muſcle cut from the limb trembles and palpitates for long after; the heart ſeparated from the body contracts when irritated; the bowels, when torn from the body, continue their periſtaltic motion, ſo as to roll upon the table, ceaſing to anſwer to ſtimuli only when they become ſtiff and cold; and too often in the human body the vis inſita loſes the exciting power of the nerves, and then palſy enſues; or, loſing all governance of the nerves, the vis inſita, acting without this regulating power, falls into partial and general convulſions. Even in vegetables, as in the ſenſitive plant, this contractile power lives. Thence comes the diſtinction betwixt the irritability of muſcles and the ſenſibility of nerves; for the irritability of muſcles ſurvives the animal, as when it is active after death; ſurvives the life of the part, or the feelings of the whole ſyſtem, as in univerſal palſy, where the vital motions continue entire and perfect, and where the muſcles, though not obedient to the will, are ſubject to irregular and violent actions; and it ſurvives the connection with the reſt of the ſyſtem, as where animals very tenacious of life are cut into parts:—but ſenſibility, the property of the nerves, gives the various modifications of ſenſe, as viſion, hearing, and the reſt; gives alſo the general ſenſe of pleaſure or pain, and makes the ſyſtem, according to its various conditions, feel vigorous and healthy, or weary and low. And thus the eye feels, and the ſkin feels; but their appointed ſtimuli produce no motions in theſe parts; they are ſenſible but not irritable. The heart, the inteſtines, the urinary bladder, and all the muſcles of voluntary motion, anſwer to ſtimuli with a quick and forcible contraction; and yet they hardly feel the ſtimuli by which theſe contractions are produced, or at leaſt they do not convey that feeling to the brain. There is no conſciouſneſs of preſent ſtimulus in thoſe parts which are called into action by the impulſe of the nerves, and at the command of the will: ſo that muſcular parts have all the irritability of the ſyſtem, with but little feeling, and that little owing to the nerves which enter into their ſubſtance; while nerves have all the ſenſibility of the ſyſtem, but no motion.

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* The irritability of a muſcle is, perhaps, more properly the vis inſita or inherent power called into immediate action by the preſence of ſtimuli; and as for the names of Tonic Power, Vital Power, and the reſt, the terms are quite undefined, and may perhaps have referred rather to the combined effect of all the powers of life, and of all the properties of inanimate matter, of nervous ſympathy, elaſticity, and of muſcular power combined.

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* See a moſt ingenious diſſertation by my pupil Mr Fowler, the firſt writer, in this country, on this very intereſting novelty, where the operations of this new excitement are explained.

The VIS INSITA is a power that is in continual force, preſerving the parts ready for their proper ſtimuli, whatever theſe may be: one ſet obeying their own peculiar ſtimuli chiefly; while others are obedient to the nervous power and the influence of the will. The heart is ſtimulated by the quantity or quality of its blood; the ſtomach by the preſence of food; the inteſtines by their contents: the urine ſtimulates the bladder; the venereal appetite ſtimulates the genital ſyſtem; the fœtus ſtimulates the womb; and the voluntary muſcles (if we may be allowed to gueſs at a thing ſo little known) are excited by the nerves, and ſo are obedient to the will; for, to our limited view, the nerves ſeem to be the ſole meſſengers of theſe commands; and any ſtimulus to the nerves moves the muſcles like the commands of the will. The abſence of the due ſtimulus to each, or the preſence of ordinary ſtimuli in too great power, will excite enormous and irregular motions; as fulneſs of blood in the heart, poiſons in the ſtomach, acrimonies in the inteſtinal canal, or the paſſions of anger or fear in the ſyſtem of the voluntary muſcles. The due ſtimuli preſerve their right tone and action; but theſe violent ſtimuli hurt their irritability or moving power; the heart acts weakly after fevers; the appetite is languid after debauch; the limbs are weakened by labour; and the whole ſyſtem is ruined by exceſs. Thus the functions by which the ſyſtem lives, the heart, the ſtomach, the bowels, and the womb, the various ſorts of veſſels by which the fluids are conveyed, are providently removed from the influence of the will; for theſe are the machines of the ſyſtem, whoſe motions could not ſtop, muſt not be interrupted, nor lowered, nor raiſed, but muſt move and act according to the needs of the ſyſtem. Not left to the irregularities or careleſſneſs of voluntary motions, they are governed each by its own peculiar ſtimulus, and act in a continued and equal courſe.

Thus there are in the body two living powers which are as cauſe and effect in all the motions of our ſyſtem.

The NERVES ſtand as an intermedium betwixt all external objects and our general ſenſe; by the impreſſions through theſe come pleaſure and pain, and all the motives to action; by the will, returned through the nerves, all voluntary motions enſue. Thus are the nerves, as internuncii, betwixt the external impreſſion and the moving power. But nerves were never known to move under the influence of ſtimuli; the moving power is another property of a diſtinct part of our body, having its own arrangement of particles, and its own peculiar form. All motion then proceeds from the joint operation of either power; the nerves convey the impreſſions, while the muſcles contain the power; and it is here, as in other natural effects, the external cauſe changes, while the inherent property, the ſubject of its operation, remains the ſame. The nervous power is the regulator of the ſyſtem; it is the property ſuited to all the ſupports of life, upon which they act, and by which they maintain their power over our body: but it is ſubject to continual changing; it riſes and falls, is perfect or low; but the energy of the muſcle, which is to anſwer to this power, remains ever the ſame while its organization remains; the nervous power is exhauſted and languid; but the muſcular power is always perfect, always ready for the excitement of ſtimuli or for the commands of the will.

There is (if we may be allowed any expreſſion ſo looſe and indefinite) the will of the ſyſtem, and the will of the mind: it is the will of the ſyſtem that, through the medium of nerves of wide ſympathy and conſent, governs and leads in harmony all the conſenting functions of the body, and lowers and raiſes their powers, according to the weakneſs, or ſtrength, or fullneſs, or wants of the body; while the will of the mind commands thoſe voluntary motions, which it is its choice to perform. So natural ſeems that notion which has long prevailed of an archæus, or preſiding ſpirit, which, like a latent inſtinct, regulates and preſerves the ſyſtem, prompts to what is right, and creates an averſion to what is wrong, and raiſes or allays the actions of the vital organs, preſerving the ſyſtem in health, and ſtriving againſt diſeaſe. The voluntary muſcles are put under the command of the will, while the involuntary muſcles, by which the vital organs move, are inſulated and mechanical, and depend leſs on our ſpiritual part: for life and exiſtence depend leſs on feeling, or that which is allied to our ſpiritual part, and more on the irritable or moving power; and it was fit that this irritable power ſhould be divided from our feelings and our will, which are irregular and tranſitory, and apt rather to derange than to preſerve the ſyſtem.

How this diviſion is accompliſhed we do not know in any ſurer way; but we ſee that the heart, the lungs, the ſtomach, and the inteſtines, have a proportion of nerves, ſo much lower than the muſcles of voluntary motion, that the very exiſtence of theſe nerves has been denied. Yet there are nerves proper to the vital parts: the phrenic nerve goes to the diaphragm; the par vagum to the ſtomach and bowels; the ſympathetic nerve to the heart; they are ſmaller, but they are appropriated and diſtinct. Now this queſtion occurs: If the irritable power be in theſe organs, if they be endowed with the quality of feeling their own peculiar ſtimuli, and anſwering to their impulſes, what need is there for nerves? But they alſo have their nerves, that they may not want ſome living connection with that ſyſtem to which they belong; that they may flouriſh in its health, and languiſh in its diſeaſes; that they may act according to the needs, and be ſubject to the will of the ſyſtem; that the grand movers of the mechanical ſyſtem may be affected in their turns by the ſpiritual part, and thus the digeſtion, the circulation, the venereal appetite, and every vital power, are languid and depreſſed, or lively and perfect, according to the conditions of the whole: and how theſe functions are moved by anger, or joy, or fear, needs not be told. But the vital functions alſo loſe their action: "The heart acts weakly after fevers; the appetite is languid after a debauch; the limbs are weakened by labour; and the whole ſyſtem is ruined by exceſs." Theſe organs have leſs dependence on nerves; and ſo ſuſpicions ariſe, that the irritable power, the very baſis of life, may alſo fail: but how ſhould it fail? If the motions of our ſyſtem ceaſe, it muſt be either from the incapacity of the muſcles, or from the loſs of exciting power in the nerves. The nerves are liable to change, but the muſcle retains its power till its organization be deſtroyed. When the irritable power of a muſcle ceaſes, when the heart, for inſtance, begins to fail, whence can that loſs ariſe? Its power is not mechanically exhauſted, elſe from what ſource could it ever be renewed? It is not from any injury to its nerves; for the heart, when cut out from the body, may be wearied out with conſtant ſtimuli till it ceaſe to act; and it will recover by reſt, without communication with the nerves: but it is perhaps ſuch a derangement as happens in a ſpring, which, being long bent, loſes of its elaſtic power: the arrangement of its particles ſuffers by ſtraining; they are compoſed by reſt: and if the elaſtic power be thus reſtored in an inanimate ſpring, much more ſhould the contractile power recover by reſt in the muſcular fibres of a living ſyſtem.

The VIS INSITA cannot be wearied nor exhauſted; ſo the heart is unwearied in its function, or if languid or too violent in its actions, that muſt be from the power of ſtimulus being lowered or increaſed, not from any change on the inherent power. The voluntary muſcles alſo are unwearied; and ſo, after great fatigue, we are ſenſible of cramps and irregular contractions, ſhowing that they are ſtill active, but more looſely governed by the nerves, and not ſo fully under the command of the will. But the NERVOUS SYSTEM is more ſubject to wearineſs and to decay: The ſenſes become tired; the feelings of the ſyſtem are exhauſted. It is from this failing of the nervous power that violent exertions bring fatigue and pain: from this alſo that we need the refreſhment of ſleep; but during ſleep, the heart, and all the involuntary muſcles, unwearied in their functions, proceed ſtill in the ſame regular and orderly courſe.

This irritability or inherent power not only keeps the muſcles ready, each for its peculiar ſtimulus, but preſerves a balance over the whole ſyſtem of the muſcles. We know that muſcles maintain a conſtant action, independent of the nerves. The muſcles of one ſide balance the oppoſite muſcles: and if the muſcles of one ſide be relaxed by palſy, the action of the oppoſite muſcles inſtantly appears: or if a limb be luxated, and its muſcles diſplaced, they perſevere in a violent and ſpaſmodic action till they be reſtored each to its place. Have we not reaſon to believe, that if muſcles were abſolutely and entirely quieſcent, they could not be ſo inſtantaneouſly called into action; but that by this continual tenſion or tone they more readily follow the commands of the will: that by this leſſer tenſion they are prepared for greater action, and inclined to harmonize: for if all the muſcles were quieſcent, and one ſuddenly moved by the will, its antagoniſt would riſe into undue action, and the co-operating or aſſiſting muſcles would be unprepared. Whereas, by this continual tenſion of all the muſcles, one ſet is oppoſed to another, is conſenting with it, and is ready to co-operate with it, or to oppoſe it in the due degree: the mind has but to incline the power towards one ſet, and immediate and orderly motions enſue.

The NERVOUS INFLUENCE, again, is as a mere ſtimulus to the voluntary muſcles, as blood is to the heart, or the fœtus, or any foreign body, to the womb. It loſes its influence over the ſyſtem faſter than the ordinary powers of life do; and the irritable ſtate of the muſcles continues long after the voluntary motion, or the power of excitement from the nerves, is gone: for when we die ſlowly, this inherent power is exhauſted in the ſtruggles for life. If, while in perfect health, we are killed by a ſudden blow, the irritable power of the muſcles ſurvives the nervous ſyſtem many hours or days, and the fleſh trembles, and the abſorbents continue to abſorb; and often, as after ſuffocation, we can, by operating upon this poor remains of life, reſtore the circulation, reanimate the nervous ſyſtem, and recover that life which ſeemed to have entirely left the body; and thus the nervous influence, which ſeemed to animate the ſyſtem, and to be the prime mover and ſource of life, owes its reſtoration to that which was thought to be but a ſecondary power. It is this remains of contractile power which fixes the dead body in whatever poſture it is placed: It is this remains of irritability which preſerves freſhneſs in the animal which ſeemed dead, but which is really dying ſtill: For the moment this lingering portion of life is gone, the body diſſolves, and falls down; and ſo we judge of freſhneſs by the rigidity of the fleſh, and foreſee approaching putrefaction by its becoming ſoft. There is no putrefaction in creatures ſuddenly killed, as in the accidents which happen to man, or in killing animals by a ſudden blow; in theſe the body continues freſh and ſuſceptible of ſtimuli long after death: but if this inherent power, this irritable nature of the fibre, be exhauſted before death, or in the moment of death, then does the body fall quickly into the condition of dead matter, running through thoſe changes which are the only true marks of death. The fiſh, which is allowed to ſtruggle till it be dead; the ox, overdriven before it be brought to the ſlaughter; the animal killed by lightning, which ſuddenly explodes (if we may be allowed the expreſſion) all the powers of life—in theſe the contractile power is effectually exhauſted; no mark of irritability remains; putrefaction comes quickly on: and ſo in thoſe who die of the plague, of poiſon, of fevers, or of any ſudden and violent diſeaſe, which at once extinguiſhes life, in the vulgar ſenſe, and robs the ſyſtem of that remnant of life which the phyſiologiſt could produce to view; in all theſe caſes, the body becomes putrid in a few hours. If a body becomes putrid ſo early in warm climates, it is not merely becauſe putrefaction is favoured by heat; but it is becauſe heat exhauſts the vital power, and often a part of the body has loſt its organized power, and is almoſt putrid, before the whole be dead. We find that we are wrong in this, that when a body has loſt all feeling and motion, we pronounce it dead; the nerves indeed have ceaſed to do their office; all feeling and conſciouſneſs is gone; but the mere animal power ſurvives the nerves, and through it the whole ſyſtem may be recalled into perfect life.

The powers and privileges of the nervous ſyſtem muſt not be ranked too high nor valued too low: the perfect animal feels and moves by the nervous power; but ſurely its muſcles are actuated by a law of their own nature: The heart of the chick begins to move before we dare preſume that there is any organ for diſtributing this nervous power. The punctum ſaliens is the heart of the chick; it is ſeen beating while the body of the chick is but a rude, unformed, and gelatinous maſs; daily this active centre increaſes in ſtrength and power; and it has a delicate feeling of ſtimuli, and it quickly reacts, ſo as "to fly out into angry and perturbed motions" by the application of a ſtimulus. It is excited by increaſed heat, and languiſhes when cold, till at laſt it dies; then it ceaſes to act, but ſtill heat reſtores it to life: And is not the proof ſtronger in the grown animal, when we cut out the heart, which anſwers to ſtimuli for ſome time; at laſt ſeems to have its power exhauſted; it lies dead for ſome time, till it again recovers its power. If this power proceeded from the nerves, how could it be renewed? but if it reſide in the muſcle only, it may have been wearied, and may revive; its organization may have been deranged, and may be reſtored by reſt from ſtimuli; and its parts may be compoſed again, reſuming their relative ſituation, and their active arrangement and form; or though it may be inſenſible to a ſtimulus long applied, it may be ſtill alive, even to a lower ſtimulus of another kind; or it may awake again to the feeling of that ſtimulus, which, by being too long applied, had loſt it power.

Senſibility depends upon the nerves; motion on the muſcles: both are equally admirable and inſcrutible; the one conducing to all the enjoyments, and all the ſufferings of life, and to the intellectual faculties of man; the other being the chief ſupport of animal life, and the ſource of all the bodily powers.

As for the MECHANICAL POWERS, by which the contractions of the muſcular fibre is forwarded or retarded, they are not what they have been believed; for we find few circumſtances in the origin, inſertion, or forms of muſcles, to favour their power, but many by which their power is abridged. There are certain points where the length of lever gives an increaſe of power. The maſtoid proceſs, and the occiput, are as levers for the head; the ſpines of the vertebræ, for the back; the olecranon, for the arm; and the piſiform bone, for the hand. The pelvis and the jutting trochanters, are as levers for the thigh; the patella is a lever for the leg; the heel-bone is a lever for the whole foot; and the arch of the foot is as a lever for the toes. Theſe are not the whole, but they are perhaps the chief, levers in the human body. In all the other implantations the muſcle is fixed, not behind the joint, but betwixt the joint and the weight that is to be moved. There is a greater loſs of power when inſerted near to the joint; there is leſs loſs of power when the tendon is inſerted far from the joint; and though we call ſuch inſertion a longer or ſhorter lever, there is always ſome loſs of power, and the true levers in the body are very few. Far from providing mechanical forms to encreaſe the power, nature has provided ſuch a quantity of contractile power as to compenſate for any loſs of effect: So, in place of increaſing the effect of muſcles by levers, pulleys, and hinges, there is in almoſt every muſcle a great abatement of its force by the form of the bones which it is deſtined to move; for muſcles loſe of their effect by their being implanted, not behind the joint, but betwixt the joint and the body to be moved; by the inſertion of almoſt all muſcles being very oblique, with reſpect to the motions which they are to perform; ſo that half their force is loſt upon the immoveable end of the bone. Much force is loſt by a muſcle paſſing over many joints: one ſet of fibres in a muſcle hinders the action of adjoining fibres, and every degree of contraction takes from that muſcle an equal proportion of it power. Thus, everywhere in the human body, is power ſacrificed to the form and fitneſs of the part; that the joints may be ſmaller than the limbs; that the limbs may be proportioned to the body: and beauty and conveniency is gained by the ſacrifice of that power which is not needed in the ſyſtem, ſince the wiſdom and goodneſs of the Creator has appointed a degree of force in the muſcles more than proportioned to all this loſs of the mechanical power. Thoſe who will admire the ways of Providence, ſhould know how to admire! Nature is not ſeeking to compenſate for want of power, by the advantages of pulleys, and levers, and mechanical helps; nor is it in the forms of the parts that the Infinite Wiſdom is to be found: for among other gifts, ſuch a portion of this ſpirit is given to man, that he has uſed the pulleys, and levers, accelerations of motion, and all the mechanical powers that reſult from it; he has invented valves of infinite variety, each perfect and true to its particular office; he has anticipated all that he has found in the mechaniſm of the human body; but the living power which compenſates for the want of levers, which allows everywhere power to be ſacrificed to the beauty of form, which has ſtrength in convulſive and violent actions to break the very bones; this is the act of Infinite Wiſdom, on which our admiration ſhould chiefly dwell.

It is but the very elements, of ſo deep a ſubject, that can be delivered here. I muſt proceed to explain thoſe proviſions for eaſy motion, which may be conſidered as belonging to the muſcles and bones, and as preparing us for a knowledge of the joints.

CHAP. X.

OF THE TENDONS, LIGAMENTS, BURSÆ, AND ALL THE PARTS WHICH BELONG TO THE BONES OR MUSCLES, OR WHICH ENTER INTO THE CONSTITUTION OF A JOINT.

THE bones and muſcles themſelves are but the ſmalleſt part of that beautiful mechaniſm by which the motions of the human body are performed; for the parts by which the bones are joined to each other, or the muſcles fixed into the bones, are ſo changed and varied in their forms, according to the uſes of each part, as to give a natural and eaſy ſhape to the limbs, ſecurity and firmneſs to their motions, and lubricity and ſmoothneſs to the joints by which theſe motions are performed: and this apparatus deſerves our attention, not merely that we may know the forms of theſe joinings, but that we may learn ſomething of the nature and uſes of each part, and the various degrees of ſenſibility with which each is endowed; for from this kind of ſtudy concluſions will ariſe which may lead us to the knowledge of their diſeaſes, ſuggeſting the means of their prevention and cure.

There is a difference in the parts of the human body, according to the ſeveral uſes for which they are deſigned ; ſome are vaſcular and ſoft, others bony and hard ; ſome ſenſible, and very prone to inflammation and diſeaſe, others callous and inſenſible, having little action in their natural ſtate, and little proneneſs to diſeaſe. The greater part of the human body is merely inanimate matter, united into a moving and perfect whole, by the ſyſtem of the nerves which abound in each creature according to its wants, and are diſtributed in each ſyſtem according to the uſes and functions of every part. In ſome places there is ſuch a conflux of nerves as form the moſt delicate and perfect ſenſe, endowing that part with the fulleſt life ; while others are left without nerves, almoſt inanimate and dead ; leſt feeling, where it ought not to be, ſhould derange the whole ſyſtem.

The living parts of the ſyſtem are the muſcles and nerves ; the muſcles to move the body, and perform its offices, each muſcle anſwering to its particular ſtimuli, and moſt of them obeying the commands of the will ; the nerves to feel, to ſuffer, and to enjoy, to iſſue the commands of the will, and to move the muſcles to action : but ſtill the muſcles have their own peculiar kind of life, ſuperior to the nerves, and independent of them, always acting, always capable of greater action, always ready to receive the impulſe of the nerves. It is a power which ſurvives that of the nerves, acting even when ſevered from the general ſyſtem ; and acting often on the living body without the impulſe of the nerves, and ſometimes in oppoſition to the will. The dead matter of the ſyſtem joins theſe living parts, and performs for them every ſubſervient office ; forms coverings for the brain, coats for the nerves ; ſheaths for the muſcles and tendons; ligaments and burſæs; and all the apparatus for the joints; unites them into one whole by a continued tiſſue of cellular ſubſtance, which, from part to part through all its various forms, has no interruption, and ſuffers no change, but ſtill preſerves its own inanimate nature, while it joins the living parts to each other. The tendons, ligaments, perioſteum, and burſæ, are all compoſed of this cellular ſubſtance, which by its elaſticity binds and connects the parts, and by its dead and inſenſible nature is leſs expoſed to diſeaſe, and is a fitter medium of connection for the living ſyſtem.

OF THE FORMS OF THE CELLULAR SUBSTANCE.

UNDER various modifications and ſhapes this dead matter performs moſt important offices among the living parts:—1. It forms CELLS over all the body, which allow the parts to glide and move eaſily; which contain the fluid that makes all the motion of parts more eaſy and free; which ſtore up fat to fill the interſtices, to ſupport the parts in their action, to give a plumpneſs to all the body, and to be reabſorbed for the needs and uſes of the ſyſtem. This cellular ſubſtance is peculiarly uſeful to the muſcles; dives in among them; keeps their fibres at ſuch due diſtance that each may have its action; ſupports and lubricates them; ſo that perhaps the difference of ſtrength, in health and diſeaſe, depends, at leaſt in ſome degree, upon this ſupport. The thinner halitus makes the play of the fibres eaſy and free; and the fat not only ſupports the fibres in their action, but lubricates them ſo, that a want of it is painful, while a ſuperabundance of it incumbers the body. And Haller ſeems to have believed, that a diſeaſed increaſe of it might not only oppreſs, but almoſt annihilate, the muſcular fibre.

2. But it is ſtill further eſſential to a muſcle, that while it moves, it ſhould neither be hurt itſelf nor harm the ſurrounding parts. Therefore, where one muſcle moves over another muſcle, ſoft fleſh upon ſoft fleſh like itſelf, there can be no hurtful friction, and the cellular ſubſtance is looſe and natural, preſerving its common form. But where tendons rub upon tendons, or bones upon bones, or where tendons rub upon muſcles, or upon each other; ſome defence is needed, and the cellular ſubſtance aſſumes a new form. The cells are run together into one large cell, with thicker coats, and a more copious exudation; ſo that, being more liberally bedewed with a gelatinous mucus, it prevents the bad effects of friction, and is called a BURSA MUCOSA, or MUCOUS bag. Theſe mucous bags are placed under rubbing tendons, and chiefly about the greater joints; ſome are large, and others ſmall; their glairy liquor is the ſame with that which bedews the celluar ſubſtance or the cavities of the joints; and the proviſion of nature is ſo perfect, that the occaſions which require burſæ ſeem to form them by friction out of the common cellular ſubſtance.

3. It is often uſeful that an individual muſcle ſhould be encloſed in a tendinous ſheath, to give it ſtrength and firmneſs, and to preſerve it in its ſhape. All muſcles, or almoſt all muſcles, form for themſelves individual ſheaths, ſuch as are ſeen encloſing the ſupra-ſpinatus and infra-ſpinatus of the ſcapula; the biceps

humeri, and moſt of the muſcles of the leg and thigh; but it is eſpecially neceſſary that the whole muſcles of the limb ſhould be incloſed in ſome ſtronger membrane than the common ſkin, both to give form to the limb and ſtrength to its muſcles, and to keep the individual muſcles in their proper places, which otherwiſe might be luxated and diſplaced. And ſo the trunk of the body, the arm, the thigh, the leg, are bound each with a ſtrong, ſmooth, and gliſtening ſheath, formed out of the cellular ſubſtance, condenſed and thickened by continual preſſure. And this alſo is thicker and ſtronger according to the need that there may be for ſuch a help; for it is weaker over the flat muſcles of the back or of the abdomen, ſtronger on the arm, ſtronger ſtill over the ſtrong muſcles of the thigh. It is hardly to be diſtinguiſhed in the child; grows thicker and ſtronger as we advance in years and in ſtrength, and in the arms of workmen it grows particularly thick and ſtrong, encreaſing in the back, ſhoulder, or limbs, according to the particular kind of labour. Theſe are the membranes which, by encloſing the muſcles like ſheaths, are called the VAGINA, or FASCIA of the arm, the leg, the thigh, &c.

4. TENDONS or ropes were needed, for the muſcles could not be implanted thick and fleſhy into each bone without a deformity of the limbs, and eſpecially of the joints; which would have been not unſhapely only, but which muſt have abridged them of their motions and uſes. Where a muſcle is not implanted directly into a bone, tendons are ſeldom required; and ſo there are no tendons in the heart, the tongue, the œſophagus, the ſtomach, inteſtines, or bladder. But

where tendons paſs over bones, or traverſe the joints, their force is concentrated into narrower bounds; and long tendons are fixed to the ends of the muſcles to pull the bones: theſe tendons were once believed to be but the collected fibres of muſcles, gathered into a more condenſed form; by which condenſation their properties of feeling and motion were loſt, while they became hard, white, and gliſtening; and it was believed that parts which were fleſhy in the child became tendinous in the adult. But we know by the microſcope that the tendon is not truly continued from the fleſh; that the fibres of the tendon and of the fleſh are not in the ſame line, the fibres of all penniform muſcles running into their tendon, in a direction more or leſs oblique; and good anatomiſts have been able to ſeparate the tendon from the fleſh, without any violence, and with the blunteſt knives. Muſcles are irritable and have nerves; tendons are quite dead, have no viſible nerves, have neither feeling nor motion, nor any endowment by which we ſhould believe them to be allied to the living parts of the ſyſtem; and many tendons, as the expanſion of the palmaris, may be unravelled into mere cellular ſubſtance.

5. The PERIOSTEUM is merely a condenſation of the common cellular ſubſtance, formed in ſucceſſive layers: and the tendons are of the ſubſtance of the perioſteum; they mix with the perioſteum, and are implanted into it. In diſſecting a child, we tear up the perioſtæum along with tendons, and without hurting the bones; but in proceſs of time, the perioſteum, and conſequently the tendons, are inſeparably fixed to the

bones. The perioſteum, tendons, faſciæ, and burſæ mucoſæ, are all of one ſubſtance, and of one common nature; they are various modifications of that dead matter which, having but little vaſcularity, and no feeling, and hardly any diſpoſition to diſeaſe, is the fitteſt for its office, and bears the rougheſt uſage in our experiments, and the moſt violent ſhocks in the motions of the body, without any ſigns of feeling, and without falling into diſeaſe.

6. Theſe tendons muſt be bound firmly down; for if they were to riſe from the bones during the actions of the muſcles to which they belong, the effect of contraction would be loſt, and they would diſorder the joint, ſtarting out in a ſtraight line from bone to bone like a bow-ſtring over the arch of a bow. The ſame inanimate ſubſtance ſtill performs this office alſo; for the tendons of one muſcle often ſplit to form a ſheath or ring for the next; or their tendons, after taking hold of the bone, ſpread their expanſion out over all the bone, ſo as to form an entire ſheath for the finger and toe; or there is a wide groove in the bone which receives the tendons, and it is lined with a cartilage and with a lubricated membrane; the membrane comes off from the lips of the groove, or from corners or edges of the bone, paſſes over the tendons ſo as to form a bridge, or often it forms a longer ſheath, as in the fingers, or where the peronæi muſcles paſs behind the ankle; and thus the VAGINA or SHEATHS of the TENDONS are connected with the tendons, perioſteum, and other modifications of the common cellular membrane.

7. The perioſteum, which has run along one bone, leaves it at the head, and forming a bag for the joint,

goes onwards to the next bone. Thus the perioſteum of all the bones is one continued membrane, paſſing from point to point: each bone is tied to the next by its own perioſteum; and this membrane betwixt the end of one bone and the beginning of the next, is ſo thickened into a ſtrong and hard bag, as to form the capſule of the joint; and the perioſteum is aſſiſted in performing this office by the tendons, faſciæ, burſæ, and all that confuſion of cellular ſubſtance which ſurrounds the joint. The CAPSULE of the JOINT is then a firm and thick bag, which, like a ligament, binds the bones together, keeps their heads and proceſſes in their right places, contains that glairy liquor with which the heads of moving bones are bedewed, and prevents the adjacent parts from falling inwards, or being catched betwixt the bones in the bendings of the joints. The capſule of every joint proceeds from the perioſteum, and is ſtrengthened by the tendons; it is formed, like theſe parts, out of the cellular membrane; and when a bone is broken, or its perioſteum deſtroyed by any accident or diſeaſe, when a tendon ſnaps acroſs, when a joint is luxated, and the capſule torn, the injury is ſoon repaired by a thickening of the cellular ſubſtance round the breach; and wherever a bone, being luxated, is left unreduced, a new ſocket, new perioſteum, new ligaments, and new burſæ, are formed out of the common cellular ſubſtance; and though the tendons may have been torn away from the head of the bone, they are fixed again, taking a new hold upon the bone.

8. There are other LIGAMENTS of a JOINT which prevent its luxation, guarding it at its ſides, or round all

its circle, according to its degree of motion: and thoſe ligaments are of the ſame nature with the firſt or burſal ligaments; ariſe, like them, from the perioſteum chiefly; or indeed are truly but a thickening of the burſal ligament at certain points.

The univerſal connection of theſe parts is now ſufficiently explained, ſince we have followed the ſeveral forms of cellular ſubſtance: 1ſt, Clothing the bones with a thick membrane, which, though inſenſible, and almoſt inanimate in its own nature, conveys blood-veſſels, the means of life, to the bones, and is named perioſteum: 2dly, The ſame perioſteum, thickened and ſtrengthened by the adheſion of ſurrounding parts, ſo as to form the capſules for the joints: 3dly, The tendon, alſo continued from the perioſteum, and not growing from the muſcle, but merely joined to it: 4thly, We ſee that ſmaller tendon, expanded into a thinner tendinous ſheet, as in the brawn of the leg where the ham-ſtrings (whoſe expanſion ſtrengthens the knee-joint) go down over the muſcles of the leg: 5thly, We ſee the perpendicular partitions of this faſcia going down among the muſcles, and dividing them from each other; and the cellular ſubſtance, which lies under the faſcia, and immediately ſurrounds the muſcle, cannot be diſtinguiſhed from the inner ſurface of the faſcia itſelf: 6thly, And as for the burſæ, we ſee that they are formed wherever a tendon rubs over a bone. The upper ſurface of the burſa is formed by the tendon which rubs over the bone; the lower ſurface of the ſame burſa is formed by the perioſteum of the bone which it defends; the ſides are formed by the common cellular ſubſtance. Its cavity appears to be merely an enlarged cell; and the burſæ mucoſæ and capſular ligaments are plainly of one and the ſame nature; their liquors are the ſame; they often open into one another naturally, or if not naturally, at leaſt it is no diſeaſe, ſince no bad effects enſue.

I muſt now explain more fully the conſtitution and nature of all the leſs feeling parts: For what I have ſaid might be thought to imply abſolute inſenſibility and total exemption from diſeaſe or pain; whereas the ſenſibility of tendons, ligaments, burſæ, and joints, ſtands on the ſame footing with the feeling of bones: They are inſenſible in health; not eaſily injured; entering ſlowly into diſeaſe; but their diſeaſes are equally dreadful from their duration and from their pain: for by inflammation their organization is deranged, their healthy conſiſtence deſtroyed, and their ſenſibility excited in a dreadful degree.

The tendons of animals have been cut or pierced with embowelling needles; they have been pinched with nippers, and torn and cauteriſed; they have been burnt with a lighted ſtick, while the creatures neither ſtruggled nor ſhrunk from the irritation, nor ever gave the ſmalleſt ſign of pain. Oil of vitriol has been poured upon each of the parts belonging to a joint, and a piece of cauſtic has been dropped into its cavity, but ſtill no pain enſued; nay, ſome have been ſo bold, may I not ſay ſo vicious, as to repeat theſe experiments upon the human body, pinching, pricking, and burning the tendons of the leg, and piercing them with knives, in a poor man, whoſe condition did not exempt him from this hard treatment; who was ignorant of this injuſtice that was done to him, while his cure was protracted, and he was made a ſpectacle for a whole city. Without ſuch cruel and inhuman practices, we do not want opportunities of knowing, that, in the human body alſo, the tendons and burſæ have no acute feeling. When we cut open a faſcia or tendinous membrane, there is little pain: when (as in amputation) we cut the ragged tendons even and neat, there is no pain: when we ſnip with our ſciſſars the ragged tendons of a bruiſed finger to cut it off, the patient does not feel: when we ſee tendons of ſuppurating fingers lying flat in their ſheaths, we draw them out with our forceps, or touch them with probes, without exciting pain: in the old practice of ſewing tendons there was ſome danger, but no immediate pain: when we cut down into the cavity of a joint, ſtill the pain is but ſlight. In a luxation there is comparatively little pain. There is no pain when the ligament of the patella is broken away from the tibia, nor when the great Achillis tendon is torn. There is but little pain in the moments of thoſe accidents which appear ſlight in the time, but which turn out to be the moſt dreadful ſprains. Yet after rupture of the patella, the knee inflames and ſwells: after rupture of the Achillis tendon, there is ſwelling and inflammation, with ſuch adheſion of the parts as makes the patient lame: after the ſlighteſt ſprain ſuch inflammation ſometimes comes on as deſtroys the joint. There is but little pain when we firſt make an opening into any joint; yet it often brings on ſuch pain and fever that the patient dies. In ſhort, every thing conſpires to prove, that though in wounds of the leſs feeling parts, there is indeed future danger, there is no immediate pain. Still there are many accidents which prove to us, that even in health the joints are not entirely exempted from pain: a ſmart ſtroke on the knuckles, or a blow on the elbow, or a fall upon the knee, are not perhaps the pureſt inſtances of feeling in joints; for ſuch blow may have hurt ſome external nerve: but when a ſmall moveable cartilage forms within the joint of the knee, though it be ſmall and very ſmooth, and lodged fairly within the cavity of the joint, it often gets betwixt the bones, cauſing inſtant lameneſs; the moment it cauſes this lameneſs, it brings dreadful pains: the pain, the lameneſs, and all the feeling of inconveniency, ſubſide the inſtant that this cartilage is moved away from betwixt the bones; and the joint continues eaſy till this moving cartilage chances again to fall in betwixt the heads of the bones. Even the pain from a blow upon the knee, for example, is plainly within the joint, and is cauſed by the force with which the patella is ſtruck down againſt the ends of the bones. What indeed is a ſprain, but a general violence and twiſting of all the parts which compoſe the joint? Theſe parts are of one common nature, and may be arranged and enumerated thus: A joint is compoſed of the heads of the bones, ſwelling out into a broader articulating ſurface, and of a thin plate of cartilage, which covers and defends the head of each bone; ſometimes of ſmall and moveable cartilages which roll upon the bones, and follow all the motions of the joint, and, like friction-wheels in machines of human invention, abate the bad effects of motion. There are mucous glands, or rather mucous bags, which convey a lubricating fluid: and there is a burſal ligament, which forms the purſe of the joint, binds the bones together, contains the ſynovia, and prevents the ſurrounding parts from being catched in the joint: There are leſſer ligaments on the outſide of this, going along the ſides of the joint, and paſſing from point to point: There are great tendons moving over the joint and burſæ, or mucous bags, which accompany theſe tendons, and prevent the violence which their continual rubbing might do to the bones. All theſe parts are of one conſtitution and nature; we cannot ſay that they are inſenſible, for their feeling is only deferred; it is ſlow, but not the leſs ſevere. The eye feels the inſtant that a mote falls upon it; but the ſkin does not feel a bliſter till it has been ſome hours applied; the ligaments and joints feel ſtill leſs in the inſtant that any injury is done: but as the inflammation of the bliſter excites the feeling, and deſtroys the fabric of the ſkin, producing pain and derangement of its parts, the inflammation of joints, and of all the parts belonging to them, breaks up the organization of the part, evolves the feeling, and then in them alſo comes diſeaſe and violent pain. They are ſlow in entering into action; but, once excited, they continue to act with a perſeverance quite unknown in any other part of the ſyſtem. Their mode of action, whatever it may be at the time, is not eaſily changed: if at reſt, they are not eaſily moved to action, and their exceſſive action once begun is not eaſily allayed. The diſeaſes are infinite to which theſe parts are ſubject. They are ſubject to dropſical effuſions; they are ſubject to gelatinous concretions; they are ſubject to ſlight inflammation, to ſuppuration, to eroſions of their cartilages, and to exfoliation of their bones: correſponding with the dropſies, ſuppurations, and mortifications of the ſofter and more feeling parts. Rheumatiſm is an inflammation round the joints, with a ſlighter effuſion, which is ſoon abſorbed: Chronic rheumatiſm is a tedious and ſlow inflammation, with gelatinous effuſions round the tendons, and permanent ſwelling and lameneſs of the joints. Gout in a joint is a high inflammation, with a ſecretion of earthy matter into its cavity. The inflammation of tendons is ſprain: effuſion of gelatinous matter round them is ganglion: ſuppurations in the tendinous ſheaths is whitloe: the inflammation of burſæ is falſe white ſwelling, not eaſily diſtinguiſhed from the true: the diſeaſe of the joint itſelf is either a dropſy, where the joint, though emptied by the lancet, is filled up again in a few hours, ſhowing how continual, and how profuſe, both the exhalation and abſorption of joints naturally is; or it is white ſwelling, which, next to conſumption, is the moſt dreadful of all ſcrophulous diſeaſes, which begins by inflammation in the joint itſelf, is marked by ſtiffneſs, weakneſs, loſs of motion, and pain; which goes on through all the ſtages of high inflammation, dreadful pain, deſtruction of cartilages, enlargement of bones, fœtid ſuppurations, and ſpontaneous openings of the joints; which ſometimes ſtops by an effuſion of callus and concretion of the bones, forming a ſtiff joint, but which oftener ends in hectic fever, diarrhœa, morning ſweats, and extreme weakneſs; ſo that the patient dies, exhauſted with fever and pain.

BOOK III.

OF THE JOINTS.

CHAP. I.

JOINTS OF THE HEAD AND TRUNK.

JOINTS OF THE HEAD AND SPINE.

Almost every thing relating to the heads and proceſſes of the bones, and every propoſition concerning the motions which they have to perform, has been already explained, anticipating much of the anatomy of the joints: and the principles of motion mentioned in deſcribing the bones ſhall form the chief propoſitions on which my deſcriptions of joints ſhall be arranged, ſeeking that method chiefly by which the joints may be eaſily and rapidly explained; for it is a ſubject on which volumes might be beſtowed, and not in vain.

We may compare, in the following order, the chief motions of the head and trunk. The head is ſo placed upon the oblique ſurfaces of the atlas, that it cannot turn in circles; but at that joint all the nodding motions are performed. The atlas reſts ſo upon the dentatus, that there all the turning motions are performed. The neck and loins have their vertebræ ſo looſely framed, with ſuch perpendicular proceſſes and eaſy joints, that there all the bending motions are performed; while the back is fixed, or almoſt fixed, by its connection with the ribs, and by the obliquity and length of its ſpines; and though, upon the whole, the ſpine turns many degrees, yet it is with a limited and elaſtic motion where the whole turning is great, but the movement of each individual bone is ſmall.

To ſecure theſe motions, we find, 1. The occipital condyles received into hollows of the atlas, where the oblique poſition of the condyles ſecures the joint, the occipital condyles looking outwards, the articulating ſurfaces of the atlas looking towards each other, the occiput ſet down betwixt them, ſo as to be ſecured towards either ſide, and the obliquity of the joint being ſuch withal as to prevent the head from turning round. Theſe joints of the occiput with the atlas are, like the greater joints of the body, ſecured with regular capſules or bag-like ligaments for each condyle, each riſing from a rough ſurface on the vertebra, and being fixed into a roughneſs at the root of the condyle. 2. We find a flat membranous ligament, which extends from the ring of the atlas to the ring of the occipital hole, cloſing the interſtice betwixt the occiput and the atlas: It is confounded at the ſides with the capſules of the articulating proceſſes;

is very ſtrong before; and at the middle ſhort point of the atlas it ſeems a diſtinct ligament, which is ſtrong only at this point, and very lax and membranous behind[*]. 3. We find the atlas tied to the dentatus by a more complete order of ligaments. Theſe are, 1ſt, (as betwixt the atlas and dentatus), regular capſules or bags, fixing the condyles of one vertebra to the condyles of the other. 2dly, A croſs ligament[†], which, croſſing the ring of the firſt vertebra, makes a bridge, embraces the neck of the tooth-like proceſs, and ties it down in its place. 3dly, A ſmooth and cartilaginous ſurface all round the root of the tooth-like proceſs, where this tooth of the dentatus turns in the ring of the atlas, and is bound by the ligament; and this rolling of the atlas upon the axis of the dentatus is ſo fair and proper a joint, that it alſo is all included in a capſular ligament. 4thly, The point of the tooth-like proceſs having threaded the ring of the atlas, almoſt touches the occipital hole; and there another ligament ties it by its point to the occipital hole[‡].

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[*] This is part of what Winſlow called LIGAMENTUM INFUNDIBILIFORME, a FUNNEL-LIKE LIGAMENT, joining the firſt vertebra to the occiput.

[†] Viz. LIGAMENTUM TRANSVERSALE, or TRANSVERSUM; and what are called the APPENDICES of the TRANSVERSE LIGAMENT, are merely its edges, extending upwards and downwards, to be fixed into the dentatus, and into the occipital hole, ſo as to incloſe the tooth like proceſs of the dentatus in a capſule.

[‡] There are two flat ligaments which come from about the neck or root of the tooth-like proceſs, and which go obliquely upwards, to be fixed into the groove juſt behind the lip of the occipital hole; but

All the other vertebræ have another kind of articulation; to which the occiput, atlas, and dentatus, are the only exceptions; for their motions are particular, and quite different from the reſt. The atlas and dentatus bend, turn, and roll, by connections reſembling the common joints of the body; but the other vertebræ are united, each by its INTERVERTEBRAL SUBSTANCE, to the bones above and below; they are alſo united by their articulating proceſſes to each other: each articulating proceſs is held to another by a diſtinct capſule; each intervertebral ſubſtance is ſecured, bound down, and ſtrengthened by ſtrong ligaments; for the intervertebral ſubſtance, which of itſelf adheres very ſtrongly to the perioſteum, and to the rough ſocket-like ſurface upon the body of each vertebra, is further ſecured by a ſort of croſs ligament, which go from the rim or edge of one vertebra to the edge of the next, over the intervertebral ſubſtance; and ſo, by adhering to the intervertebral ſubſtance, they ſtrengthen it. Theſe ligaments croſs each other over the interſtice betwixt each vertebra, and are very ſtrong. They are very regular, beautiful, and ſhining, and are named INTERVERTEBRAL LIGAMENTS.

The ſpine is further ſecured by a general ligamentous or tendinous expanſion, which goes over the fore parts of all the vertebræ from top to bottom of the ſpine. It begins at the fore part of the atlas; it almoſt paſſes the body of the dentatus, or is but very ſlightly

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but the ligament from the point of the tooth-like proceſs is not what it has been ſuppoſed, a fair round ligament of ſome ſtrength; there is nothing more than a few ſtraggling fibres of ligament going from the point to the occiput, though Euſtachius has drawn it round and ſtrong.

ſlightly attached to it. It is at firſt pointed, ſmall, and round; it begins to expand upon the third vertebra of the neck, ſo as to cover almoſt all its body. It goes down along the bones, chiefly on their fore parts, and is but little obſerved on their ſides. It is weaker in the neck, where there is much motion; ſtronger in the back, where there is none; weaker again in the loins, where the vertebræ move; but ſtill on the bodies of all the vertebræ it is ſeen white, ſhining, and tendinous. We can diſtinguiſh all along the ſpine interruptions and faſciculi, or firmer bundles, going from piece to piece of the ſpine; which faſciculi are indeed very ſeldom continued without interruption farther than the length of two or three vertebræ; yet the whole is ſo much continued, that it is conſidered as one uninterrupted ſheath, and is called the EXTERNAL or ANTERIOR VAGINA, or LIGAMENT of the SPINE*.

But ſtill the canal of the ſpine were left open and undefended, rough and dangerous to the ſpinal marrow, if internal ligaments were not added to theſe. The rings of the vertebræ are held at a conſiderable diſtance from each other, by the thickneſs of the intervertebral ſubſtance, and by the correſponding length of the oblique proceſſes: but this ſpace is filled up by a ſtrong flat ligament, which goes from the edge of one ring to the edge of another; and ſo extending from the articulating proceſſes, backwards to the ſpinous proceſſes, they fill up all the interſtice, complete the canal of the ſpinal marrow, and bind the bones together with great ſtrength[*]: Theſe are aſſiſted in their office of holding the vertebræ together, by a continuation of the ſame ligament, or of a ligamentous membrane connected with it, which runs all the way onwards to the ends of the ſpinous proceſſes, where they are ſtrengthened by accidental faſciculi[†]; and in the middle vertebræ of the back, but not of thoſe of the loins or neck, ſimilar ligaments are found alſo betwixt the tranſverſe proceſſes[‡].

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* The LIGAMENTUM COMMUNE ANTERIUS, FASCIA LONGITUDINALIS ANTERIOR, FASCIA LIGAMENTOSA, &c. It is from this ligament in the loins that the crura diaphragmatis ariſe, with tendons flat and gliſtening like the ligament itſelf, and hardly to be diſtinguiſhed from it.

Next, there is another internal ligament, which is not interrupted from bone to bone, but runs along all the length of the ſpine, within the medullary canal, and it correſponds ſo with the external vagina, or anterior ligament of the ſpine, that it is called the POSTERIOR or INTERNAL ligament[§]. It begins at the occiput, lies flat upon the back part of the bodies of the vertebræ; at the interſtice of every vertebra it ſpreads out broad upon the intervertebral ſubſtance, doing the ſame office within that the intervertebral ligaments do without. It is broader above; it grows gradually narrower towards the loins. Although it is called a vagina or ſheath, it does by no means ſurround nor incloſe the ſpinal marrow, but is entirely confined to the covering of the bodies of the vertebræ, never going beyond the ſetting off of the articulating ſurfaces, or the place where the nerves go out. It adheres firmly to the bones, and does not belong at all to the ſpinal marrow. It ſhould rather be called a ligament for the bones than a ſheath for the medulla. The anterior ligament prevents ſtraining of the ſpine backwards: this one prevents the bending of the ſpine too much forwards; and they incloſe betwixt them the bodies of the vertebræ and their intervertebral ſubſtances.

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[*] They are named the LIGAMENTA SUBFLAVA CRURUM PROCESSUUM SPINOSORUM.

[†] Theſe are named the MEMBRANÆ INTERSPINALES, and LIGAMENTA APICES SPINARUM COMITANTES. The ligaments which tie the points of the ſpines, running from point to point, make a long ligament, which ſtretches down all the ſpine.

[‡] Called LIGAMENTA PROCESSUUM TRANSVERSORUM, and found only from the fifth to the tenth vertebra of the back.

[§] FASCIA LIGAMENTOSA POSTICA, FASCIA LONGITUDINALIS POSTICA, LIGAMENTUM COMMUNE POSTERIUS.

There is yet a third internal ligament, which belongs entirely to the neck; it is called APPARATUS LIGAMENTOSUS COLLI; it begins from the edge of the occipital bone, deſcends in the canal of the vertebræ, is thin and flat, and adheres firmly to the body of each vertebra, covering the tooth-like proceſs. The irregular faſciculi, or bundles of this ligament, ſtretch from bone to bone; and the whole of the apparatus ligamentoſus extends from the edge of the occipital hole to the fourth vertebra of the neck, where it ends. Its chief uſe is alſo as a ligament, merely fixing the head to the neck. The dura mater is within theſe, immediately incloſing the ſpinal marrow. The ligaments which I have juſt named may be well enough allowed to be " at once ligaments for the bones, and a ſheath for the medulla." But there is no ſuch ſheath as that called ligamentum infundibiliforme by Winſlow; for either they are peculiar and diſtinct ligaments for the bones, ſuch as I have deſcribed, or they belong excluſively to the medulla, as the dura mater, which is indeed ſtrengthened at certain points into the thickneſs of a ligament; but the only cloſe connection of the ſpinal marrow with the ligaments of the ſpine is juſt at the hole of the occipital bone, and for a little way down; through all the reſt of the ſpine, the connection is by the looſeſt cellular ſubſtance.

OF THE LOWER JAW.

THE LOWER JAW is, by its natural form, almoſt a ſtrict hinge, and the lateral motion in grinding is but very ſlight. The joint is formed by a deep hollow or ſocket in the temporal bone; by a ridge, which ſtands juſt before the proper ſocket, at the root of the zygomatic proceſs; and by a long ſmall head or condyle, which is placed acroſs the long branch or condyloid proceſs of the jaw. Theſe form the joint; and the condyle, the hollow of the temporal bone, and the root of the zygomatic proceſs, are all covered with articulating cartilage. The joint is completed by a capſule of the common form, which ariſes from the neck of the condyle, and which is ſo fixed into the temporal bone as to include both the proper ſocket and the root of the zygomatic proceſs. Thence it is manifeſt, that in the motions of the jaw, this tranſverſe ridge is required as a part of its articulating ſurface; that the common and leſſer motions are performed by the condyle moving in the deepeſt part of its ſocket; that the larger and wider openings of the mouth are performed by ſuch depreſſion of the jaw as makes its condyle mount upon the root of the zygomatic proceſs; while the luxation of the jaw is a ſtarting forwards of the condyle, till it is lodged quite before and under the zygomatic proceſs, and the condyle ſtanding upon the higheſt ridge, is the dangerous poſition in which luxation is moſt eaſily produced.

To render theſe motions very eaſy and free, a moveable cartilage is interpoſed. We find ſuch cartilages in the joints of the clavicle, wriſt, knee, and jaw, becauſe the motions are continual and rapid. The moveable cartilage is thin in its centre, and thicker towards its edges, by which it rather deepens than fills up the hollow of the joint. It correſponds in ſhape with the head or condyle of the jaw, and with the hollow of the temporal bone. It moves with every motion of the jaw, facilitates the common motions, and prevents luxation; but the joint is ſtill more ſtrongly ſecured by the ſtrength of its pterygoid and temporal muſcles, which are inſerted cloſe round the joint, than by any ſtrength of its capſule. It is the muſcles which prevent luxation; and it is their action alſo that makes luxation, when it has happened, ſo difficult to reduce.

RIBS.

The ribs have two joints, and a hinge-like motion, riſing and falling alternately as we draw in or let out the breath. The two joints of the ribs are thus ſecured: Firſt, the proper head of the ribs being hinged upon the intervertebral ſubſtance, and touching two vertebræ, it is tied to the bodies of each by a regular capſule: the bag is regular, is lubricated within, and is as perfect as any joint in the body; it is radiated without, ſo as to expand pretty broad upon the ſides of the vertebræ, and has a ſort of diviſion as if into two faſciculi; the one belonging to the vertebra above, the other to the vertebra below: they gradually vaniſh, and mix with the perioſteum upon the bodies of the vertebræ; theſe are named LIGAMENTUM CAPITELLI COSTARUM, as belonging to the little heads of the ribs.

The back of the rib touches the fore part of the tranſverſe proceſs, and is articulated there; conſequently there is a ſmall capſular ligament belonging to this joint alſo: but this joint is further ſecured by two ſmall ligaments, which come from the tranſverſe proceſs of the vertebra, and take hold on the neck of the rib: one ſhort ligament coming from the point of the tranſverſe proceſs, is behind the rib, and is thence named LIGAMENTUM TRANSVERSARIUM EXTERNUM; another, rather longer, comes from the inner face of the tranſverſe proceſs, goes a little round the neck of the rib, is implanted into the lower edge of the rib, and is named LIGAMENTUM TRANSVERSARIUM INTERNUM: another ſmall ligament, exactly oppoſite to this, going into the neck of the rib upon its back part, is alſo very regular; and other ſubſidiary ligaments from different points aſſiſt theſe or ſupply their place.

The ribs are fixed into the ſternum by their cartilages; each of which has a round head, a diſtinct ſocket, a regular capſule, and ligaments which expand upon the ſurface of the ſternum, much in the ſame way that the ligamenta capitelli expand upon the bodies of the vertebræ: a tendinous membrane alſo binds the cartilages of the ribs one to another, croſſes over the interſtice, and ſo covers the intercoſtal muſcles with a ſort of faſcia; and the whole ſurface

face of the ſternum and that of the cartilages is covered with this tendinous expanſion, which belongs confuſedly to the origins of the pectoral muſcles, to the ligaments of the ribs and ſternum, and to the perioſteum of that bone.

CHAP. II.

JOINTS OF THE SHOULDER, ARM, AND HAND.

CLAVICLE.

The joining of the clavicle with the ſternum is the hinge upon which the whole arm moves, and is the only point by which the arm is connected with the trunk: the round button-like head of the clavicle rolls upon the articulating ſurface of the upper bone of the ſternum: it is in ſuch continual motion that ſome particular proviſion is required; and accordingly it has, like the condyle of the jaw, a ſmall moving cartilage, which rolls betwixt this head and the ſternum. The cartilage is thin, and of a mucous nature; it is moveable in ſome degree, yet it is fixed by one edge to the head of the clavicle. This joint is incloſed in a ſtrong capſule; conſiſting firſt of a bag, and then of an outer order of fibres, which go out in a radiated form, upon the ſurface of the ſternum, like the ligaments of the ribs; and they croſs and cover the ſternum, ſo that

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the ligaments of the oppoſite ſides meet; and this meeting forms a cord acroſs the upper part of the ſternum, which is named INTERCLAVICULAR LIGAMENT. Thus is the clavicle fixed to the ſternum, and another broad ligament alſo ties it to the firſt rib.

The joining of the clavicle with the ſcapula is by the edge of the flat clavicle touching the edge of the acromion proceſſes with a narrow but flat articulating ſurface. Both ſurfaces, viz. of the acromion and of the clavicle, are covered with a thin articulating cartilage: in ſome ſubjects a moveable cartilage is alſo found here. It is a regular joint, and is very ſeldom obliterated; yet its motion, though continual, is not very free; it is rather a ſhuffling and bending of the ſcapula upon this bone, favouring the play of the other joints. It is ſecured firſt by a capſular ligament, which is in itſelf delicate and thin, but which is ſtrengthened by many ligamentous bands, which paſs (over the capſule) betwixt the clavicle and the acromion proceſs: the clavicle, as it paſſes over the point of the coracoid proceſs, is tied down to it by a ligament of conſiderable ſtrength, which comes from the point of the coracoid proceſs, is implanted into the lower or inner edge of the clavicle, and is named LIGAMENTUM COMMUNE TRAPEZOIDES; trapezoid, on account of its ſquare form, and commune, becauſe it goes from the ſcapula to the clavicle; while other ligaments, going from one proceſs of the ſcapula to another, are named proper or peculiar ligaments of the ſcapula. There is a ſmall ſlip of ligament which joins this, coming from the tendon of the ſubclavian muſcle.

SHOULDER-JOINT.

The shoulder is one of the moſt beautiful joints, looſe and moveable, very free in its motions, but very liable to be diſplaced. To form this joint, the humerus has a large round and flattened head; the cavity of the ſcapula*, which receives this head, is oval or triangular, ſmall, and very ſhallow: it is eked out with a thick cartilaginous border, which increaſes the hollow of the ſocket; but ſtill it is ſo ſhallow that the humerus cannot be ſo much ſaid to be lodged in the glenoid cavity, as to be laid upon it. Its capſule or bag is very looſe and wide, coming from the edges of the glenoid cavity, and implanted round the neck of the bone. The joint is richly bedewed with mucus; or rather with a mixed ſecretion, which is partly ſecreted by a fimbriated organ, conſiſting of lacunæ or bags, the common organ for this ſecretion through all the joints, and by a thinner exudation from thoſe extreme arteries, which terminate, with open mouths, upon the internal ſurface of the bag.

By the ſhallowneſs of its ſocket, and the largeneſs of its head; by the looſeneſs of its capſule; by all the forms and circumſtances of its ſtructure;—the ſhoulder is exceedingly looſe, and very liable to be diſplaced: it has this looſe ſtructure and ſuperficial ſocket, that its motions may be free; but ſeldom is there any great advantage gained in the human body without a counterbalance of weakneſs and danger; and every where in the limbs we obſerve that a joint is weak and liable to luxation in proportion as its motions are free and large. Yet the ſhoulder-joint is not without ſome kind of defence; its ſocket is ſhallow, but it is guarded by the largeſt projecting proceſſes in all the body; by the acromion projecting and ſtrengthening it above; and by the coracoid proceſs within; its ligament is lax, eaſily torn, and uſeful rather for confining the ſynovia, and keeping the head of the ſhoulder bone oppoſite to its proper cavity, than in ſecuring the joint by any ſtrength it has; therefore a ligament extends from the coracoid to the acromion proceſs*, which completes the defences of the joint above, and at its inner ſide; and there comes alſo from the point of the acromion proceſs an additional ligament which adheres to the capſule: But the circumſtance from which the chief ſtrength of the ſhoulder-joint is derived, is the inſertion of the four muſcles which come from the ſhoulder-blade cloſe round the head of the bone; ſo that they adhere to the capſular ligament, pull it up to prevent its being checked in the motions of the joint; ſtrengthen it by their thickneſs, for they are ſpread upon it: and the contraction of the muſcles hold the humerus in its place; their total relaxation (as in certain caſes of weakneſs) ſuffers the humerus to drop away from the ſcapula, without any fall or accident, forming what we are accuſtomed to call a luxation of the humerus from an internal cauſe; and the ſhoulder cannot be luxated by a fall without ſuch violence as tears up theſe muſcles by the roots. We muſt add to this anatomy of the joint, that it is ſurrounded by numbers of burſæ or mucous bags *: one under the tendons of the ſubſcapularis; one under the ſhort head of the biceps muſcles; one betwixt the coracoid proceſs and the ſhoulder-bone; and one under the acromion proceſs of the ſcapula, exceedingly large: and theſe are ſo fairly parts of the joint, that very commonly they open into it with communications, either perfectly natural or at leaſt not hurtful, either originally exiſting or formed by continual friction. It ſhould alſo be remembered, that the long tendinous head of the biceps muſcle comes from the margin of the ſocket, directly over the ball of the os humeri, and through the capſule, by a particular hole.

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* It is called glenoid cavity from the Greek name of a joint, and the name is not abſolutely appropriated to the ſcapula.

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* LIGAMENTUM PROPRIUM TRIANGULARE SCAPULÆ.

ELBOW.

The elbow-joint is formed by three bones; the humerus, radius, and ulna: the ulna bends backwards and forwards upon the ſhoulder-bone; the radius bends upon the ſhoulder-bone along with the ulna; it always muſt accompany the ulna, but it alſo has a motion of its own, rolling in circles; its round button-like head rolling continually with its edge upon a ſocket in the ulna, and with its flat face upon the tubercle of the humerus. The whole compoſes one joint, and is incloſed in one capſule: the bones accompany each other in their luxations, as well as in their natural motions: the ulna is never diſlocated without the radius being alſo diſplaced; a circumſtance which is but too

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* Vide Monro's Tables of the Burſæ Mucoſæ, where all theſe parts are repreſented; the knowledge of which is ſo very uſeful for the ſurgeon. I have opened this great burſa under the acromion proceſs, and let out four pounds of the peculiar mucus and gelatinous lumps with which the diſeaſed burſæ are commonly filled,

too little noticed, and, ſo far as I remember, hardly conſidered or known. The general CAPSULE ariſes from the humerus, from both the tubercles, and all round the two hollows which receive the olecranon and coronoid proceſſes of the ulna; it is implanted again into the tip of the olecranon, and all round that ſigmoid cavity which receives the lower end of the humerus, and all round the edge of the coronary proceſs. It is alſo fixed round the neck of the radius; it comprehends, in one bag, the humerus, radius, and ulna; and unites them into one joint, performing two motions, viz. flexion and extenſion by the ulna, and rolling by the radius. The joint is lubricated by mucus and by fat, which is found chiefly about the olecranon; and that the bones may be further ſecured, additional ligaments are ſpread out upon them, which are all without the common capſule of the joint lying upon it, and ſtrengthening it at the neceſſary points.

1. There is the common capſule incloſing the whole. 2. It is the form of every hinge-joint (and this is one of the pureſt) to have its capſule ſtrengthened at the ſides; and the ſides of this, the elbow-joint, are ſtrengthened by two faſciculi or ligamentous heads, which, coming from the tubercles of the humerus, ſpread a little upon the capſule, and adhere to it like part of its ſubſtance. One, from the outer condyle, ſpreads upon the neck of the radius, and is named the EXTERNAL LATERAL LIGAMENT: one from the inner condyle of the humerus, goes upon the inſide of the capſule, and ſtrengthens it there: it is implanted near the root of the coronoid proceſs of the ulna, and is named the INTERNAL LATERAL LIGAMENT. 3. The continual rolling motion of the radius requires a peculiar ligament;

and this peculiar ligament of the radius is named LIGAMENTUM CORONARIUM, becauſe it encircles the neck of the radius; ANULARE or ORBICULARE, from its hoop or ring-like form. It is a very ſtrong and narrow ſtripe or band, which ariſes from that part of the ulna where the radius rolls upon it, and ſurrounds the radius, making at leaſt two-thirds of a circle; and ſo having turned over the neck of the radius, is inſerted into the oppoſite ſide of the ulna. This is commonly deſcribed as a diſtinct ligament ſurrounding the neck of the radius, and having the common capſule implanted into its upper edge; but in truth it is, like the others, a thicker band of the common capſule, but with a diſtinction much more particular here, by the contraſt of the great thickneſs of the coronary ligament, and the extreme thinneſs of the capſule at the fore part: for the capſule of every hinge-joint is ſtrong only at its ſides; other bands from the outer condyle, and from the coronary proceſs of the ulna, ſtrengthen this ligament of the radius, and are known by the general name of ACCESSORY LIGAMENTS of the coronoid ligament, as the lateral ones are known by the name of ACCESSORY LIGAMENTS to the capſule.

So that there is, 1. A complete capſule which encloſes all the bones; 2. Lateral ligaments which make the main ſtrength of the joint; 3. A coronary ligament which regulates and ſtrengthens the rolling motions of the radius, and keeps it firm, turning like a ſpindle in its buſh. The whole joint is ſurrounded with cellular ſubſtance; the regularity of its ligaments is confounded by the adheſions of muſcles and tendons: though it is, on the whole, weak behind and before, and very ſtrong at its ſides, yet tendinous and ligamentous fibres croſs it in all directions; ſo that the capſule, and its aſſiſting ligaments, are irregular and rough without; but gelatinous, ſmooth, and gloſſy within.

WRIST.

THE WRIST is one of the moſt moveable joints in the body, having the ſtrength of a mere hinge-joint (becauſe it is almoſt a ſtrict hinge, by the connection of the long ball of the carpus with the long hollow of the radius); and having, at the ſame time, all the properties of the moſt moveable joint, by the free turning of the radius, without the weakneſs which is peculiar to the circular and free moving joints. Theſe diſtinctions divide the wriſt-joint into its two parts.

1. The articulation formed by the ſcaphoid and lunated bones, which form an oval ball of articulation, and the great ſcaphoid cavity of the radius which receives this ball. The end of the ulna does not properly enter into the cavity of the wriſt, but its end, or little round head, is covered with a moveable cartilage, and that cartilage repreſents the end of the ulna. Now this firſt joint, viz. of the ſcaphoid and lunated bones, the head of the radius, and the moveable cartilage which repreſents the head of the ulna, are ſurrounded by the general capſule or bag of the joint. The capſule ariſes from the ends of the radius and of the ulna; from the ſtyloid point of the one round to the ſame point of the other; and is implanted near the lower rank of the carpal bones. Though it adheres firſt to the ſcaphoid and lunated bones, it paſſes them, going over all the bones of the carpus,

eſpecially in the palm, ſo as to add ſtrength to their peculiar ligaments; and in the palm, the tendons for the fingers run over it: ſo it forms on one ſide an additional ligament for the carpus; on the other, it forms the floor of the tendinous ſheath, a ſmooth and lubricated ſurface for the tendons to run upon. This general ligament is ſtrengthened by particular ones coming from the ſtyloid proceſſes of the radius and of the ulna. But there are ſo many irregular points of bone about the wriſt, that the little faſciculi, with which this capſule is covered and ſtrengthened, are innumerable. Within this joint, and ſtretching from the groove betwixt the ſcaphoid and lunated bones, there is an internal ligament of a ſoft and pulpy nature; it is named LIGAMENTUM MUCOSUM: but the very name ſhows that it is leſs valuable as a ligament (ſince the joint is already well enough ſecured), than as a conductor for the lacunæ or ducts which ſeparate the mucus.

2. The articulation by which the hand performs all its turning motions is that of the radius with the ulna: this is ſet apart altogether from the general articulation of the joint. The lateral cavity of the radius receives the little round head of the ulna; they are encloſed in their own peculiar capſule; which is ſo looſe about the bones, that although it is a regular capſule of the common form, it has the name of MEMBRANA CAPSULARIS SACCIFORMIS: Thus there is one joint within another; a moveable cartilage betwixt them, and the capſule of one, the more moveable joint, peculiarly wide, and not ſo ſtrong; all which ſhould be conſidered in thinking about luxations of the wriſt.

The carpal bones are connected with each other ſo very cloſely, that the name of joint can hardly be uſed. They are rather fixed than jointed together. Each bone has four ſmooth articulating ſurfaces, by which it is united to the adjoining bones. The firſt two bones form the great ball of the wriſt; the ſecond row again is united with the firſt by a ſort of ball and ſocket; for the os magnum, which is the central bone of the ſecond row, has a large round head, which is received into the lunated hollow of the os lunare, which is the central bone of the firſt row. The firſt row is thus united to the ſecond by a diſtinct and general capſule; in addition to which each ſingle bone is tied to the next adjoining, by a regular capſular ligament within, and by flat croſs ligaments without, or rather by many bundles of ligaments, which croſs each other in a very complicated manner; and the little flat and ſhining faſciculi give the whole a radiated or ſtar-like form *.

The metacarpal bones are alſo joined to the carpal in one row, by a line of joints which are as one joint; beſides their common capſule, the metacarpal of each finger has its peculiar ligaments proceeding in a radiated or ſtar-like form from the carpal bones, and going out broad upon the metacarpal bones; and ſo numerous, that each metacarpal bone is ſecurely tied by ligaments

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* Theſe are the ligaments which are really ſo unimportant to the anatomiſt or to the ſurgeon, but which are ſo laboriouſly deſcribed under the titles of LIGAMENTA BREVIA, OBLIQUA TRANSVERSARIA, and PROPRIA OSSIUM CARPI; for they do in fact croſs and traverſe the carpus in every poſſible direction.

gaments to one or two of the bones of the carpus*; and at their heads, where the fingers are implanted upon them, forming the knuckles, they are again tied by flat ligaments, which go from head to head of the metacarpal bones†, binding them together, permitting a ſlight bending towards each other, ſo as to make a hollow in the hand, but no ſuch wide motion as might aſſiſt the fingers; they are but as a foundation upon which the fingers ſtand and move.

FINGERS.

The joints of the fingers are formed by round heads in the upper end of one row of bones, and by hollow ſockets on the lower ends of the next row. Each joint is qualified by the round form of its head to be a circular and free moving joint; but it is reſtricted by the forms of its ligaments to the nature of a hinge-joint; for each finger joint is included firſt in a fair round capſule or bag, of the ordinary form; but that capſule is ſtrengthened by very diſtinct lateral ligaments upon its ſides, which lateral ligaments form the chief ſtrength of the joints; above theſe lateral ligaments the joint is ſtrengthened by a broad faſcia or ſheath, which comes from the tendons of the interoſſei muſcles, covers the backs of all the fingers, and which is eſpecially ſtrong over the joints. One part of the apparatus of the wriſt-joint is the ſmooth and lubricated SHEATH, in which the tendons of the fingers run. It is formed in part by the outer ſide of the capſule of the wriſt, and in part by that bridge of ligament which proceeds from the four corner points of the carpal bones. This ſheath is lined with a delicate and ſofter modification of the common tendinous membrane; is fully bedewed with mucus; and is fairly to be ranked with the burſæ mucoſæ, as it is indeed, like them, a ſhut ſack. But it is farther croſſed in ſuch a manner by partitions belonging to each flexor tendon, that each of them may be ſaid to have its appropriated burſa mucoſa. And theſe burſæ, to prevent the bad conſequences of friction, are put both betwixt the croſs ligament and the tendons, and alſo betwixt the tendons of the uppermoſt muſcle and of the deeper one, and again betwixt the tendons of the fingers and of the thumb.

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* And theſe alſo are named, according to their ſeveral directions, LIGAMENTA ARTICULARIA, LATERALIA, RECTA, PERPENDICULARIA, &c.

† Theſe are named the LIGAMENTA INTEROSSEA.

In the ſame way the ſheaths of the tendons, as they run along the fingers, may be conſidered as part of the apparatus of their joints; for the firſt ſet of burſæ, viz. thoſe which lie in the palm of the hand, ſtop before they reach the firſt joints of the fingers, and then other longitudinal burſæ begin from the firſt joint of the fingers, and go all along them to the laſt joint; forming a ſheath for the tendons to run in, which does at once the office of a ſtrong ligament, binding them down in their places, and which is ſo lubricated on its internal ſurface as to ſave the neceſſity of other burſæ. Theſe ſheaths are thicker in certain points, ſo as to form croſs rings of ſtrong ligament; but the common ſheath and theſe thicker rings ſtill form one continued canal: theſe are named the SHEATHS and ANNULAR LIGAMENTS, or CROSS LIGAMENTS*, of the fingers, and are of the ſame nature with the burſæ. Beſides theſe, there are no diſtinct burſæ on the fingers, but there are ſeveral about the wriſt, and one eſpecially of a conſiderable ſize at the root of the thumb †.

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* LIGAMENTA VAGINALIA, LIGAMENTA CRUCIATA PHALANGUM, &c.

CHAP. III.

JOINTS OF THE THIGH, LEG, AND ANKLE.

OF THE HIP-JOINT.

THE acetabulum, which is rough in the naked bone, is naturally lined with a thick and very ſmooth cartilage. The head of the thigh-bone is covered with a ſimilar cartilage, alſo very thick and ſmooth; and theſe cartilages almoſt fill up that deep dimple which is ſeen in the centre of the head of the thigh-bone, and ſmooth that hole which is formed in the centre of the ſocket, by the meeting of the ſeveral pieces of which it is compoſed. The ſocket is not only deep in its bones, but is further deepened by the cartilage which tips the edge of the ſocket, and which ſtands up to a conſiderable height. The ſocket is imperfect at that ſide which looks towards the thyroid hole; the bony edge is entirely awanting there, and the ſpace is filled up by a ſtrong cartilaginous ligament which goes acroſs this gap, from the one point to the other, and from its going acroſs is named the LIGAMENTUM LABRI CARTILA-

GINÆI

[†] Vide Monro's Burſæ Mucoſæ.

GINÆI TRANSVERSALE*. The capſular ligament of the hip-joint is the thickeſt and ſtrongeſt of all the body. It is, like other capſules, a reflection and thickening of the perioſteum; the perioſteum coming along the outſide of the bone, leaves it at the edge of the ſocket. The perioſteum, or rather perichondrium from the inſide of the ſocket, comes up to the edge, and meets the outer layer. They unite together, ſo as to form the general capſule, encloſing the ring-like cartilage, which tips the edge of the ſocket between them. This ligament encloſes all the bones from the edges of the ſocket to the roots of the trochanters, embracing not only the head but the neck of the thigh-bone. The outer plate, continuous with the perioſteum, is thick and ſtrong, and is aſſiſted by much cellular ſubſtance condenſed round it, and it is further thickened by ſlips which come from the iliacus, glutæus, and other muſcles which paſs over the joint, while the external plate of the ligament lines the whole with a ſoft and well lubricated coat.

In addition to this general capſule, there are two internal ligaments, 1ſt, The round ligament, as it is called, which comes from the centre of the ſocket to be fixed into the centre of the ball of the thigh-bone. It is not round, but flat or triangular. It has a broad triangular baſis, rooted in the ſocket exactly at that place where the ſeveral bones of the ſocket meet, forming a triangular ridge, which gives this triangular form to the central ligament. It has three angles, and three flat ſides. It is broad where it ariſes from the bottom of the ſocket, is about an inch and a half in length, grows narrower as it goes outwards towards the head of the bone, and is almoſt round where it is implanted into the dimple in the head of the thigh-bone; at which point it is ſo fixed as to leave a very remarkable roughneſs in the naked bone. But round the roots of this ligament, and in the bottom of the ſocket, there is left a pretty deep hollow, which is ſaid to be filled up with the ſynovial gland. It is wonderful how eaſily authors talk of the ſynovial gland, as if they had ſeen it; they deſcribe very formally its affections and diſeaſes, as when hurt by a blow upon the trochanter; yet there is no diſtinct gland to be found. There is a fringed and ragged maſs lodged in the bottom of the ſocket, hanging out into the hollow, and continually rubbed by the ball of the thigh-bone in its motions: the fringes and points certainly are ducts from which we can ſqueeze out mucus; but it is by no means proved that they belong to a ſynovial gland; and it looks rather as if the ducts were themſelves the ſecreting organ, like the lacunæ or mucous bags in the tongue, or in the urethra vagina, œſophagus, and other hollow tubes. Such a ſtructure is fitter for ſuffering the ſtrong preſſure and continual action of the thigh-bone than any determined gland. We ſee then nothing but mucous ducts of a fringed form, hanging down from this hollow into the cavity of the joint; a quantity of fat accompanying theſe fringes; and a pappy mucous membrane, which keeps theſe fringes and fatty membranes orderly and in their places, and which ties them ſo to the angles of the triangular ligament, that they muſt move with the motions of the joint. This mucous membrane, which keeps theſe fatty fringes orderly, has two or three ſmall bridles in different directions; whence they are named the LIGAMENTA MUCOSA, or ligamentula maſſæ adipoſæ glandulofa; and this may be conſidered as the continued inflection of the ſofter internal lamella of the capſule, which not only lines the ſocket, but is reflected over the central ligament, and over the globe of the thigh-bone, covering them alſo with a delicate mucous coat. Other fringes of the ſame kind are found at the lower part of the joint, lying round the neck of the thigh-bone, near the angle where the capſular ligament is implanted into the root of the great trochanter: the liquor from theſe mucous fimbriæ, with the general ſerous exudations, are mixed and blended for lubricating the joint.

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* This ligament is double; that is, there is one on the inſide of the edge, and one on the outſide; thence it is often reckoned as two ligaments, viz. LIGAMENTUM TRANSVERSALE INTERNUM et EXTERNUM.

This capſule, which is naturally the thickeſt and ſtrongeſt in the body, almoſt a quarter of an inch in thickneſs, is farther ſtrengthened by many additions: for a ſlip of very ſtrong tendinous or cellular ſubſtance condenſed comes down from the lower ſpinous proceſs of the os ilium, and ſpreads out over the capſule, and ſtrengthens it very much on its fore part; the ſmalleſt of the glutæi muſcles adheres to the capſule, and ſtrengthens it behind; the pſoas magnus and iliacus internus paſs by the inner ſide of the capſule; and though they do not abſolutely adhere to it, they depoſit much cellular ſubſtance, which is condenſed ſo as to ſtrengthen the capſule, forming at the ſame time a large burſa mucoſa betwixt their tendinous fibres and the joint. That tendon of the rectus muſcle which comes from the margin of the ſocket, lies upon the outer ſide of the capſule, adheres to it, and ſtrengthens it. The ſecurity of the hip-joint ſeems to depend more upon the ſtrength of its capſular ligament than that of almoſt any other joint.

THE KNEE-JOINT.

The knee-joint is one of the moſt ſuperficial joints, and one of the weakeſt, ſo far as relates to the bones; for the flat condyles of the thigh-bone are merely laid upon the flat head of the tibia. There is here no fair cavity receiving a large head, as in the joint of the hip; no ſlighter ball and ſocket, as in the fingers; no ſtrong overhanging bones, as in the ſhoulder; no hook-like proceſs, as in the ulna. This is not a hinge-joint, like the ankle, ſecured between two points of bone. We do not find the means of ſtrength in its bones, but in the number, ſize, and diſpoſition of the great ligaments with which its bones are joined; by virtue of theſe ligaments it is the ſtrongeſt joint of the human body, the moſt oppreſſed by great loads, the moſt exerciſed in continual motions, yet leſs frequently diſplaced than any other. But this complication of ligaments, which gives it mechanical ſtrength, is the very cauſe of its conſtitutional weakneſs; makes it very delicate; and very liable to diſeaſe.

The bones which compoſe this joint are the tibia, thigh-bone, and patella; and they are united by many ligaments, both within and without the joint.

1ſt, The CAPSULE of the KNEE is naturally very thin and delicate, tranſparent as a cobweb. This thin capſule comes from the fore part of the thigh-bone, all round the articulating ſurfaces, whence it goes downwards by the ſides of the condyles: from this origin it is inſerted into all the edge of the rotula, and in ſuch a way as to keep the rotula properly without the cavity of the joint; the capſular ligament going over its inner ſurface, and lining it with a ſmooth and delicate coat. It is fixed below into all the circle of the head of the tibia, and thus completes its circle, embracing all the bones. This capſule, naturally ſo thin and delicate, is made up from all the ſurrounding parts to a conſiderable thickneſs; firſt, it is covered behind by the heads of the gaſtrocnemii; at the ſides by the biceps and other muſcles of the ham-ſtrings; on its fore part, it is ſtrengthened by the general faſcia of the thigh, which goes down over the knee, and being there reinforced, both by its adheſion to the bones and by the broad expanſion of the vaſtus internus, ſartorius, biceps, and other muſcles which go out over the patella, it adheres to the capſule, and makes the whole very ſtrong; beſides which, there is a ligament which, lying in the ham, upon the back part of the capſule, is named, in compliment to Winſlow, LIGAMENTUM POSTICUM WINSLOWII. It is a ligament ſomewhat reſembling the lateral ligaments of the elbow. It ariſes from the outer condyle, goes obliquely acroſs the back part of the joint, adheres to it, and ſtrengthens it; but often it is not found at all, or in ſuch ſtraggling fibres as cannot be accounted as a ligament. It is manifeſt that the knee requires ſome ſuch additional ligaments behind, to ſerve as a check, and to prevent its yielding too far.

2. The knee, as being a hinge-joint, has its ſtronger ligaments at the ſides; and although we ſpeak of la-

teral ligaments in the other joints, this is the only one where the lateral ligaments are very diſtinct from the common capſule of the joint; on the inner ſide of the joint there comes down from the internal condyle of the thigh-bone a broad flat ligament, which is fixed into the inner head of the tibia, and is named the internal lateral ligament; on the outſide of the knee there deſcends from the tip of the outer condyle a much ſtronger ligament, not quite ſo flat, rather round: It extends from the condyle of the thigh-bone to the bump of the fibula, which it embraces. It is a little conical from above downwards; it is from two to three inches in length, and is named LIGAMENTUM LATERALE EXTERNUM LONGUS, to diſtinguiſh it from the next: for behind this firſt external ligament there ariſes, a little lower from the ſame condyle, along with the outer head of the gaſtrocnæmius muſcle, a ligament which is called the LIGAMENTUM LATERALE EXTERNUM BREVIUS; and it is not ſhorter only, but ſo ſcattered as not to be eaſily diſtinguiſhed, not having the true form of a lateral ligament coming down from the condyle, but of a mere ſtrengthening of the capſule, coming upwards from the knob of the fibula.

3. The joint is ſtill further ſecured by internal ligaments, which are within the cavity of the joint; they are named the CRUCIAL LIGAMENTS of the knee. They ariſe betwixt the hollow of the condyles of the thigh-bone, and are implanted into the back part of the middle riſing of the tibia: they lie in the back part of the joint, flat upon the back of the capſule; and the one croſſing a little before the other (but yet in

contact with each other at the place of croſſing), they are diſtinguiſhed by the names of ANTERIOR and POSTERIOR CRUCIAL LIGAMENTS.

The POSTERIOR CRUCIAL ligament is more perpendicular; it ariſes from the hollow betwixt the condyles of the thigh-bone, and is implanted into a roughneſs on the back of the tibia, betwixt its two cup-like hollows, and behind the tubercle which divides theſe hollows from each other. While the poſterior ariſes rather from the internal condyle, the ANTERIOR LIGAMENT ariſes properly from the external condyle, paſſes obliquely over the tuber in the articulating ſurface of the tibia, and terminates in the cup-like hollow. The effect of theſe two ligaments is more particular than is commonly obſerved; for the one goes obliquely out over the articulating ſurface of the tibia, while the other goes directly down behind the joint; and of courſe when the knee is bended, the poſterior ligament is extended; when the leg is ſtretched out, the anterior ligament is extended: they both are checks upon the motions of the joint: the anterior ligament prevents the leg going too far forewards; the poſterior ligament prevents its being too much bent back upon the thigh.

4. The moſt admirable part of the mechaniſm of this joint is the two SEMILUNAR CARTILAGES. They are ſo named from their ſemilunar form: they lie upon the top of the tibia, ſo as to fill up, each of them, one of the hollows on the top of that bone. They are thicker towards their convex edges, thinner towards their concave edges; they end by two very acute and long horns, named the CORNUA of the lunated cartilages.

In ſhort, they reſemble the ſhape of the label which we put round a wine decanter; and the two horns are tied to the tubercle or ridge that ſtands in the middle of the articular ſurface of the tibia; and conſequently they are turned towards each other ſo as to touch in their points. There are here, as in the other joints, maſſes of fat incloſing the fimbriated ends of the mucous ducts. Theſe fimbriæ and fatty bundles are formed chiefly round the circumference of the patella, commonly ſurrounding it with a complete fringe; they are alſo found at the back of the cavity, about the crucial ligaments, and in all the interſtices of the joint; the fatty bundles filling up the interſtices, protecting the mucous ducts from more violence than what is juſt neceſſary to empty them, and perhaps mixing their exudation with the mucus of the ducts.

Theſe maſſes of fat lie covered by the delicate internal ſurface of the capſule, and the mucous fimbriæ project from it.

The inner ſurface of the capſule is ſo much larger than the joint which it lines, that it makes many folds or lurks; and ſeveral of theſe are diſtinguiſhed by particular names. Thus at each ſide of the patella there are two ſuch folds, the one larger than the other; whence they are named LIGAMENTUM ALARE MAJUS, and LIGAMENTUM ALARE MINUS. Theſe two folds are like two legs, which join and form one middle fold, which runs acroſs in the very centre of the joint, viz. from the lower end of the patella to the point of the thigh-bone, in the middle betwixt the condyles. It keeps the looſer fatty bundles and fimbriated ducts in their place (viz. the hollow betwixt the condyles, where they are leaſt expoſed to harm); thence it has been long named the LIGAMENTUM MUCOSUM. The internal membrane of the joint covers alſo the ſemilunar ligaments as a perichondrium; it comes off from the ridge of the tibia, touches the horns of the ſemilunar cartilages, moves over the cartilage ſo as to give them their coat; and at the point where it firſt touches the horns it forms four little ligaments, two for the horns of each cartilage. Theſe tags, by which the four points of the lunated cartilages are tied, are named the LIGAMENTA CARTILAGINUM LUNATARUM, or more ſimply named the four adheſions of the lunated cartilages. There is a little ſlip of ligament which goes round upon the fore part of the knob of the tibia, and ties the fore parts of theſe two cartilages to each other. It is named LIGAMENTUM TRANSVERSALE COMMUNE, becauſe it goes acroſs from the fore edge of the one cartilage to the fore edge of the other, and becauſe it belongs equally to each; but for their further ſecurity, theſe cartilages alſo adhere to their outer circle or thick edge, to the internal ſurface of the general capſule of the joint, and that again adheres to the lateral ligaments which are without it; ſo that there is every ſecurity for theſe cartilages being firm enough in their places to bear the motions of the joint, and yet looſe enough to follow them eaſily.

This joint has the largeſt burſæ mucoſæ of all, and theſe perhaps the moſt frequently diſeaſed. There is one burſa above the patella, betwixt the common tendon of the extenſor muſcles and the fore part of the thigh-bone, which is no leſs than three inches in length. There is a ſmaller burſa about an inch below the patella, and under the ligament of the patella, protecting it from friction, upon the head of the tibia. Theſe burſæ, I am perſuaded, are often the ſeat of diſeaſe, when it is judged to be in the joint itſelf. But the truth is very eaſily known; for if a ſwelling appear under the patella, projecting at the ſides, and raiſing the patella from the other bones, we are ſure that it muſt be in the main cavity of the joint: but if ſwellings appear above and below the patella, then there is reaſon to believe that theſe belong to the great burſæ, which are placed above and below the patella: a complaint which is far leſs formidable than a ſwelling of the joint itſelf; I would almoſt ſay eaſily cured; for openings into theſe burſæ, though they ſhould be avoided, are leſs dangerous than openings into the joint. It is from miſtaking ſuch tumours for collections in the capſule itſelf, that authors ſpeak of openings into the joint as a familiar or eaſy thing, or think that they have done ſuch operations ſafely when probably they were puncturing the burſæ only.

Theſe burſæ mucoſæ lie under the tendon of the extenſor muſcles, and under the ligament of the patella: they are of the ſame ſubſtance with the capſule of the joint itſelf; they lie over the capſule, united to it by cellular ſubſtance, and the bundles of fat, which are diſpoſed irregularly about the joint, belong partly to the burſæ and partly to the capſule; one end projecting into the cavity of the burſæ, while the other end of the ſame fatty bundles projects into the cavity of the joint.

Thus

Thus the knee-joint, which is the moſt important in all the body; the moſt oppreſſed by the weight of the trunk, and by the accidental loads which we carry; the moſt exerciſed in the common motions of the body, and the moſt liable to ſhocks and blows; which is the moſt ſuperficial and the weakeſt in all that reſpects its bones—is the ſtrongeſt in its ligaments, and the moſt perfect in all the proviſions for eaſy motion.

1. The great CAPSULE of the joint incloſes the heads of the bone; ſecretes (in part) and contains the ſynovia; lines the joint with a ſmooth and delicate membrane; and, by turning over all the parts, and adhering to them, it forms the perichondrium for the cartilaginous heads of the bones, and the covering and ligaments for the moving cartilages of the joint.

2. This capſule, which is exquiſitely thin, and which was formed for other uſes than for giving ſtrength to the joint, is ſurrounded on all ſides with ſuch continuations of the common faſcia, and ſuch particular expanſions of the ham-ſtring and other muſcles, as, by adding outwardly ſucceſſive layers to the capſule, brings it to a conſiderable degree of ſtrength.

3. The capſule having no ſtreſs upon its fore part, is very thin upon its fore part, viz. at the ſides of the patella; but is ſtrengthened at the ſides by fair and diſtinct ligaments, going from point to point of the three great bones, and ſo large and particular as to deſerve, more than any others in the body, the name of LATERAL LIGAMENTS: at the back part of the joint the ſame ſtrength is not required as at the ſides; yet it muſt be ſtronger than at its fore part, wherefore it is

ſtrengthened by the additional bands which are ſometimes general and confuſed, but often ſo perfect and diſtinct as to be known by the name of the POSTERIOR LIGAMENT of WINSLOW; and as the lateral ligaments prevent all lateral motions, this ſtrengthening of the capſule ſerves as a check-band behind.

4. It is only in the greateſt joints that we find the additional ſecurity of INTERNAL LIGAMENTS; and the only joints where they are perfect are the joints of the hip and of the knee; the former having its round, or rather triangular, ligament, which ſecures the great ball of the thigh-bone, and fixes it in its place; the latter having its crucial ligaments, which, coming both from one point nearly, and going the one over the face of the tibia, and the other down the back of that bone, ſerve the double purpoſe of binding the bones firmly together, and of checking the larger and dangerous motions of the joint; the fore ligament preventing it going too far forwards, and the back ligament preventing it bending too much.

5. A MOVING CARTILAGE, for facilitating motion and leſſening friction, is not common, but is peculiar to thoſe joints whoſe motions are very frequent, or which move under a greater weight; ſuch are the inner head of the clavicle, the articulation of the jaw, and the joints of the wriſt and of the knee; and it is in the knee that the moveable cartilages have their moſt perfect forms and uſe, are large and flat, ſemilunar, to correſpond with the forms on the head of the tibia; thicker at their outer edges, to deepen the ſocket; and though moveable, yet ſo tied with ligaments as never to go out from their right place.

And, 6. The mucous folicular bundles of fat, and the burſæ mucoſæ, which complete the lubricating apparatus of the joint, and the mucous frenulæ or ligaments, which both conduct the mucous fringes and keep them in their place, are more perfect in the knee, and greater in number and ſize, than in any other joint.

I may well call this the moſt complicated, and (by daily and melancholy proofs) it is known to be the moſt delicate, joint of the body.

FIBULA.

The FIBULA is a ſupport to the tibia in its various accidents; it gives a broader origin to the muſcles, and it is the chief defence of the ankle-joint. It has no motion upon the tibia; the beſt authors ſpeak of it as a ſymphyſis, which claſſes it with the joinings of the pelvis, and excludes it from the liſt of true and moveable joints. It it united with the tibia by a ſort of flat cartilaginous ſurface upon either bone; it is merely laid upon the tibia, not ſunk into it. It is tied by a cloſe capſule: it has no particular ligament for itſelf; but is ſtrengthened by the external lateral ligament of the knee, which adheres to this knob, and by the inſertion of the biceps tendon, which is implanted into this point, and which ſpreads its expanded tendon over the fore part of the tibia, and holds the bones together; and the firmneſs of the fibula is further ſecured by the great interoſſeous ligament, which goes from bone to bone.

ANKLE.

The ANKLE-JOINT owes leſs of its ſtrength to ligaments than to the particular forms of its bones; for while the ſtrong lateral ligaments of the knee guard it ſo that it cannot be diſlocated till they are torn, the lower heads of the tibia and fibula ſo guard the foot that it cannot be luxated ſidewiſe without ſuch violence as breaks theſe bones: Firſt, the fibula is ſo connected with the tibia at its lower end, that they form together one cavity for receiving the aſtragulus, with two projecting points; the fibula forming the outer ankle, and the tibia forming the proceſs of the inner ankle: the joining of the fibula to the tibia here, is like that of its upper end, too cloſe to admit of the ſmalleſt motion; and it is thoroughly ſecured by particular ligaments; one of which paſſing from the fibula to the tibia on the fore part, is named the LIGAMENTUM SUPERIUS ANTICUM, conſiſting in general of one or two diſtinct flat bands. Another more continued and broader ligamentous membrane goes from the fibula to the tibia acroſs the back part, and is named LIGAMENTUM POSTICUM SUPERIUS; the LIGAMENTUM POSTICUM INFERIUS being but a ſlip of the ſame. Next comes the capſule of the joint, which joins the aſtragalus to the lower heads of the tibia and fibula; it is thinner both before and behind than we ſhould expect from the ſtrength of a joint which bears all the weight and the moſt violent motions of the body. But, in fact, the capſule everywhere ſerves other purpoſes than giving ſtrength to the joint, and never is ſtrong except by additional ligaments from without; ſo it is with the ankle-joint, the capſule of which is exceedingly thin before, but it is ſtrengthened at the back part, and eſpecially at the ſides, by ſupplementary ligaments: Firſt, a ſtrong ligament comes down from the acute point of the inner ankle, expands in a radiated form upon the general capſule; adheres to it, and ſtrengthens it, and is fixed all along the ſides of the aſtragalus: This ligament coming from one point, and expanding to be inſerted into a long line, has a triangular form, whence it is named LIGAMENTUM DELTOIDES; and while the general ligament ſecures the joint towards that ſide, the oblique fibres of its fore edge prevent the foot being too much extended, as in leaping; and its oblique fibres on the back edge prevent its being too much bended, as in climbing; but the ligaments of the outer ankle, tying it to the outer ſide of the aſtragulus, are indeed diſtinct, one going forwards, one going backwards, and one running directly downwards; one goes from the point or knob of the fibula, obliquely downwards and forwards, to be inſerted into the ſide of the aſtragalus: it is ſquare and flat, of conſiderable breadth and ſtrength, and is called LIGAMENTUM FIBULÆ ANTERIUS. Another ligament goes perpendicularly downwards, from the acute point of the outer ankle, to ſpread upon the ſide of the aſtragalus and of the capſule, and is finally inſerted into the heel-bone; this is named the LIGAMENTUM FIBULÆ PERPENDICULARE. A third ligament goes out ſtill from the ſame point, to go backwards over the back part of the capſule; adheres to the back of the capſule, and ſtrengthens it, and is named LIGAMENTUM, INTER FIBULAM ET ASTRAGALUM, POSTERIUS. There is nothing very particularly worthy of notice in the ankle-joint; for it is covered with cartilages; lined with a ſoft and MUCOUS membrane; and lubricated with mucous fimbriæ and maſſes of fat, ſuch as are found in all the joints. It is ſtronger than the other joints; it can hardly be luxated without a laceration of its ligaments, and breaking of the bones which guard it at either ſide; and it is the great violence which is required for completing this diſlocation, and the terrible complication of diſlocation, fracture, and laceration of the ſkin, which makes this accident ſo dangerous beyond any other luxation.

The ASTRAGALUS, OS CALCIS, OS NAVICULARE, and all the bones of the tarſus, are united to each other by large heads and diſtinct and peculiar joints; beſides which, the bones are croſs tied to one another by ligaments, ſo numerous and complicated that they cannot nor need not be explained They paſs acroſs from bone to bone in an infinite variety of directions; ſome longitudinal; ſome tranſverſe; and ſome obſique. There is a curious complication, which we may call a web of ligaments, covering either ſide of the foot with ſhining and ſtar-like bundles: each bone has its capſular ligaments for joining it to the next; each joint of each bone has its articulating cartilages always freſh and lubricated; each joint has, beſides its capſule, flat ſtrips of oblique, longitudinal, and tranſverſe ligaments, joining it to the neareſt bones; and the greater bones have larger and more important ligaments, as from the aſtragalus to the os calcis, from the os calcis to the os naviculare, and from that again to the ſcaphoid bone, &c.

The metatarſal bones have their capſular ligaments joining them to the tarſal bones, and they have ligaments ſtrengthening their capſules, and tying them more ſtrongly to the tarſal bones; and, as in the metacarpal

carpal bones, the ſeveral ranks are tied one to another by croſs ligaments, which paſs from the root of one bone to the root of the next. We have ligaments of the ſame deſcription and uſe, holding the metatarſal bones together, both on the upper and on the lower ſurface of the foot; and all the ligaments of the foot are of great ſtrength and thickneſs. The lower ends of the metatarſal bones have alſo tranſverſe ligaments by which they are tied to each other. The toes have hinge-joints, formed by capſules, and ſecured by lateral ligaments, as thoſe of the fingers are; and except in the ſtrength or number of ligaments, the joinings of the carpus, metacarpus, and fingers, exactly reſemble the joinings of the tarſus, metatarſus, and toes.

But theſe ligaments, though helping to join the individual bones, could not have much effect in ſupporting the whole arch of the foot. It is further ſecured by a great ligament, which extends in one triangular and flat plate from the point of the heel to the roots of each toe. This is named the APONEUROSIS PLANTARIS PEDIS; which is not merely an aponeuroſis for covering, defending, and ſupporting, the muſcles of the foot; that might have been done on eaſier terms with a faſcia, very ſlight compared with this; but the chief uſe of the plantar aponeuroſis is to ſupport the arch of the foot. It paſſes from point to point, like the bow-ſtring betwixt the two horns of a bow, and, after leaping or hard walking, it is in the ſole of the foot that we feel the ſtraining and pain; ſo that, like the palmar aponeuroſis, it ſupports the arch, gives origin to the ſhort muſcles of the toes, braces them in their action, and makes bridges under which the long tendons are allowed to paſs; it comes off from the heel in one point; it grows broader in the ſame proportion as the ſole of the foot grows broad; it is divided into three narrow heads, which make forks, and are inſerted into the roots of the ſecond, third, and fourth toes; and the great toe and the little toe have two ſmaller or lateral aponeuroſes, which cover their own particular muſcles, and are implanted into the roots of the great toe and of the little toe.

The burſæ mucoſæ ſurround the ankle and foot in great numbers. None of them having any very direct connection with the joint, and moſt of them accompanying the long tendons as they paſs behind the ankle, or in the ſole of the foot, are of that kind which we call tendinous ſheaths. Firſt, There are ſheaths of two or three inches long, which ſurround the tendons of the tibialis poſticus, and of the peronæi muſcles, as they paſs down behind the ankle. The ſheaths of the peronæi begin from that point where the tendons firſt begin to rub againſt the bone, and are continued quite down into the ſole of the foot; making firſt a common ſheath for both tendons, and then a burſa peculiar to the tendons of the peronæus brevis muſcle, and about an inch in length. Where the peronæus longus begins to paſs under the ſole of the foot, the ſheath which incloſed it behind the ankle is ſhut, and a new burſa begins; in the ſame manner, where the tendons of the flexor policis and flexor digitorum pedis paſs behind the inner ankle, a burſa of three inches in length ſurrounds them and facilitates the motion. As the tendons of the flexor muſcles go under the arch of the foot, they lie among ſoft parts, and rub chiefly againſt the fleſh of the maſſa carnea and the belly of the ſhort flexor muſcles: But whenever they touch the firſt joints of their toes, they once more rub againſt a hard bone. New burſæ are formed for the tendons. Each burſa is a diſtinct bag, running along the flat face of the toe, and is of a long ſhape, and the tendon is carried through the centre of the lubricated bag; ſo that we ſee once more that there is no true diſtinction betwixt burſæ mucoſæ and tendinous ſheaths, nor betwixt the tendinous ſheaths and the capſules of joints.

Joints have been arranged under various forms, but not with much ſucceſs; and I do not know that enumerating the joints in any particular order will either explain the motions of individual joints, or aſſiſt in recording their various forms; ſome joints are looſe and free, capable of eaſy motions, but weak in proportion, and liable to be diſplaced; ſuch is the JOINT of the SHOULDER, which rolls in every direction: other rolling joints, more limited in their motions, are better ſecured with ligaments of peculiar ſtrength; ſuch is the JOINT of the HIP, where the ligaments are of great ſtrength both within and without: ſome, wanting all circular motions, are hinge-joints by the mere form of their bones; ſuch are the LOWER JAW, the VERTEBRÆ, the ELBOW, and the ANKLE-JOINTS: ſome are hinges by their ligaments, which are then diſpoſed only along the ſides of the bones; ſuch are the KNEE, the RIBS, the FINGERS, and the TOES. Some joints partake of either motion with all the freedom of a ball and ſocket-joint, yet with the ſtrength and ſecurity of the ſtricteſt hinge: Thus the WRIST, having one joint by which its turning motions are performed,

formed, and another joint by which it rolls, has the two great endowments ſo rarely combined in any joint of the freeſt motion, and of great ſtrength; ſo alſo has the HEAD, by the combination of two joints of oppoſite uſes and forms; for its own condyles play like a mere hinge upon the atlas; and the axis of the dentatus ſecures all the properties of a circular joint: this combination gives it all the motions of either joint without their peculiar defects. But there is ſtill a third order of joints, which have ſuch an obſcure and ſhuffling motion that it cannot be obſerved. The CARPUS and METACARPUS, the TARSUS and METATARSUS, the TIBIA with the FIBULA, have theſe ſhuffling and almoſt immoveable joints; they are not intended for much motion among themſelves, but are appointed by a diffuſed and gradual yielding to facilitate the motions of other joints.

END OF THE FIRST VOLUME.